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A Journal of Plant Systematics
and
Conservation Biology

Queensland Herbarium
Department of Science, Information Technology and Innovation

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A taxonomic revision of *Pimelea* section *Epallage* (Endl.) Benth. (Thymelaeaceae) in Queensland

A.R. Bean

Summary

Bean, A.R. (2017). A taxonomic revision of *Pimelea* section *Epallage* (Endl.) Benth. (Thymelaeaceae) in Queensland. ***Austrobaileya* 10(1): 1–46**. *Pimelea* section *Epallage* is revised for Queensland and comprises 24 species, with eight species newly described, *viz*. *P. approximans* A.R.Bean, *P. chlorina* A.R.Bean, *P. confertiflora* A.R.Bean, *P. fugiens* A.R.Bean, *P. gigandra* A.R.Bean, *P. mollis* A.R.Bean, *P. plurinervia* A.R.Bean and *P. rupestris* A.R.Bean. New combinations are *P. amabilis* (Domin) A.R.Bean, *P. leptospermoides* subsp. *bowmanii* (Benth.) A.R.Bean and *P. hirsuta* subsp. *elliptifolia* (Threlfall) A.R.Bean. The distributions of all taxa are mapped, the newly named species are illustrated, and photographic images are provided for several species. *P. altior* F.Muell., *P. hirsuta* Meisn. and *P. leptostachya* Benth. are restored to species rank. Lectotypifications are provided for *P. altior*, *P. bowmanii* Benth., *P. latifolia* R.Br., *P. leptospermoides* F.Muell. and *P. leptostachya* Benth. A key is provided for the identification of all *Pimelea* species occurring in Queensland.

Key Words: Thymelaeaceae, *Pimelea*, *Pimelea* section *Epallage*, *Pimelea altior*, *Pimelea amabilis*, *Pimelea approximans*, *Pimelea bowmanii*, *Pimelea chlorina*, *Pimelea confertiflora*, *Pimelea fugiens*, *Pimelea gigandra*, *Pimelea hirsuta*, *Pimelea hirsuta* subsp. *elliptifolia*, *Pimelea latifolia*, *Pimelea leptospermoides*, *Pimelea leptospermoides* subsp. *leptospermoides*, *Pimelea leptospermoides* subsp. *bowmanii*, *Pimelea leptostachya*, *Pimelea mollis*, *Pimelea plurinervia*, *Pimelea rupestris*, Australia flora, Queensland flora, new species, morphology, identification key, distribution maps, conservation status

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Introduction

The genus *Pimelea* Banks & Sol. ex Gaertn. comprises about 140 species, with around 35 species endemic in New Zealand (Burrows 2011), and the remainder in Australia and islands to its north, with the majority occurring in non-arid parts of southern Australia. Major taxonomic studies relevant to species occurring in Queensland have been Meisner (1857), Bentham (1873), Threlfall (1983) and Rye (1990). More recent phylogenetic studies in the family include Beaumont *et al.* (2009), Motsi *et al.* (2010) and Foster *et al.* (2016). Beaumont *et al.* (2009) discussed the non-monophyly of the large African genus *Gnidia* L., and flagged the possible reduction of *Pimelea* as a subgenus of it. Motsi *et al.* (2010) presented data suggesting that *Thecanthes* Wikstr. should be returned to synonymy with *Pimelea*, but due to limited sampling, the evidence was not conclusive. Foster *et al.* (2016) sampled a much wider range of taxa and examined several gene regions, and provided very strong evidence for including *Thecanthes* within *Pimelea*.

Rye (1990) provided a sectional classification of the genus, with seven sections recognised. The present paper is concerned with one of these sections, *Pimelea* section *Epallage* (Endl.) Benth., typified by *P. curviflora* R.Br. While *P.* section *Epallage* is distributed across Australia, it has its centre of diversity in Queensland and is also well represented in New South Wales. Its members are most readily distinguished from other sections by the presence of hairs all along the stems (not just at the nodes), inflorescence bracts mostly absent, the floral tube dehiscence circumscissile, the stamens with very short filaments inserted below the base of the sepals, and the broad connective with introrse anther cells. This section contains the well-known species *P. latifolia* R.Br. and *P. sericostachya* F.Muell.,

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both of which (as currently circumscribed) are complexes comprising several distinct species. 24 Queensland taxa are recognised here as belonging to the section, including eight newly described species and a number reinstated from previous synonymies. In addition, the new combination *P. hirsuta* subsp. *elliptifolia* (Threlfall) A.R.Bean is made for a New South Wales taxon.

Phylogeny

In the maximum-likelihood phylogram of the five-gene dataset of Foster *et al.* (2016), *Pimelea* section *Epallage sensu* Rye (1990) is polyphyletic, but only because *P. sericea* R.Br. appears in a separate "Tasmanian clade". If this species is excluded, section *Epallage* is monophyletic, comprising the sequenced taxa *P. argentea* R.Br., *P. biflora* Wakef., *P. clavata* Labill., *P. curviflora* var. *divergens* Threlfall, *P. curviflora* var. *gracilis* (R.Br.) Threlfall, *P. curviflora* var. *sericea* Benth., *P. latifolia* subsp. *elliptifolia* Threlfall, *P. leptospermoides* F.Muell., *P. micrantha* F.Muell. ex Meisn., *P. sericostachya* subsp. *sericostachya, P. simplex* F.Muell. subsp. *simplex, P. strigosa* Gand., *P. trichostachya* Lindl., *P. williamsonii* J.M.Black and *P. venosa* Threlfall. *P. clavata* was included by Rye (1990) in *Pimelea* section *Pimelea.*

In the current paper, some informal species groups based on morphological grounds (named for the first described species of that group) are recognised within the Queensland species of *P.* section *Epallage*:

a) the *P. latifolia* group: *P. altior*, *P. fugiens*, *P. gigandra*, *P. latifolia*, *P. leptospermoides*, *P. mollis*, *P. plurinervia* and *P. strigosa*

b) the *P. sericostachya* group: *P. amabilis*, *P. approximans*, *P. confertiflora*, *P. leptostachya* and *P. sericostachya*

c) the *P. simplex* group: *P. elongata* Threlfall, *P. simplex* and *P. trichostachya*

d) the *P. umbratica* group: *P. aquilonia* Rye and *P. umbratica* Meisn.

Pimelea chlorina, P. curviflora and *P. rupestris* are not readily assignable to any of these groups.

Hybridisation

Burrows (2008, 2009) reported that many New Zealand *Pimelea* species hybridise with each other, and he named some new species that he considered were "stabilised hybrids". During the current study, no instance of hybridisation (indicated by plants exhibiting morphologically intermediate characteristics) has been noted in the field, or indicated on herbarium specimen labels. This is despite the fact that in Queensland, it is not uncommon to find two (rarely more) *Pimelea* species occurring in moderately close proximity.

Toxicity

The toxic properties of *Pimelea simplex* (both subspecies), *P. elongata* and *P. trichostachya* are well known (Everist 1974; Fletcher *et al.* 2009, 2014; McKenzie 2012). Consumption of these plants by cattle causes St George disease (otherwise known as Marree disease). In his discussion of *Pimelea*, Everist (1974) noted that "nearly all of them appear to be distasteful" to livestock, and that "virtually any species of *Pimelea* would be toxic if eaten in sufficient amount".

Materials and methods

This revision is based on an examination of herbarium specimens from BRI, CANB, MEL and NSW, using a binocular microscope with graticule, as well as field observations for most species. Measurements of leaves and hairs are taken from dried material, while measurements of the flower parts and seeds are from spirit material or from material reconstituted with boiling water. Distribution maps have been compiled with DIVA-GIS Version 7.5.0 (http://www.diva-gis.org), using localities or geocodes given on the labels of specimens from the herbaria listed above. Images of type specimens not present at the herbaria listed above, have been viewed on the Jstor Plants website (Jstor 2017), and the Kew Herbarium Catalogue (Kew 2017). Species treatments are arranged in alphabetical order.

Abbreviations used in the text and for specimen citations are Mt (Mountain), NP (National Park), and SF (State Forest).

Notes on major characters used

1. Indumentum length, direction, location etc.

The hairs of *Pimelea* section *Epallage* are always simple and unicellular, but there is great diversity in their thickness, length, direction, density and distribution. In some species, the hairs are noticeably shiny, i.e. they reflect light strongly, apparently associated with an increased thickness. In this paper, the length of the *longest* hairs is recorded from each specimen for the various organs, so that the range of lengths recorded includes the longest hairs on that plant part over all the plant specimens examined.

2. Leaf phyllotaxis

The phyllotaxis of mature-aged specimens in *Pimelea* section *Epallage* is often diagnostic. Two species (*P. aquilonia*, *P. umbratica*) have strictly opposite leaves on mature plants; others have leaves that vary from opposite to sub-opposite on the same plant or branch (e.g. *P. altior*); others have consistently alternate leaves (e.g. *P. trichostachya*). The sub-opposite condition is defined as where the disjunction between the leaf pairs is less than 20% of the adjacent internode length. In alternate leaves, there is no discernible pairing of leaves, except very occasionally, and then only for a single node. From observations of hundreds of herbarium specimens, it is postulated that all species in *P.* section *Epallage* have opposite leaves at the juvenile stage, and that in some species the leaves become sub-opposite or alternate as the plant ages; certainly in some specimens that comprise a whole plant, the leaves are opposite at the base and alternate higher up.

3. Leaf venation

In some species, only the central longitudinal vein (midrib) of the leaf is evident. In several species, a few lateral veins (1–6 pairs) are faintly visible on the lower surface, while in *P. plurinervia*, 10–15 pairs of lateral veins are readily visible on the lower surface.

4. Inflorescence structure

Inflorescences in *Pimelea* section *Epallage* are invariably racemose, but often the rachis is extremely short so that flowers appear to be attached to a globose or ellipsoidal 'head' or 'capitulum', and with persistent pedicels that obscure the surface of the capitulum. In other species, the rachis is elongated and the persisting pedicels are widely spaced. This type of inflorescence has been commonly referred to as 'spicate' (Threlfall 1983; Rye 1990). An intermediate form is referred to in this paper as 'cylindrical' – here the rachis is longer than the ellipsoidal types, but the flowers are not as widely spaced as in the 'spicate' type. The rachis (with attached persistent pedicels) is held on the plant long after the flowers and fruits have abscised, and can usually be found on any given mature specimen. Its shape and length are diagnostic, as are the total flower number (best determined by counting pedicels on old rachises), the distance between adjacent pedicels, and the pedicel indumentum. The peduncle length is also diagnostic, and again is most reliably measured on old (spent) inflorescences/infructescences.

In all species the inflorescence is, strictly speaking, terminal, with flowers borne at the apex of the branchlet, but in some species, a vegetative shoot develops right alongside the flower buds, and by the time the flowers have reached anthesis, the vegetative shoot has extended well past the position of floral initiation. In these species, the inflorescence is referred to as axillary (when borne in a leaf axil) or lateral (when not associated with the leaf axil). In several species (e.g. *P. rupestris*), numerous old capitula can be seen along the sides of most branches. In the 'terminal' species (e.g. *P. gigandra*), the spent capitula or linear rachises are seen at the junction between two branches, which are otherwise sterile.

5. Sexuality

A range of sexual systems are present in *Pimelea* section *Epallage*. In some species, e.g. *P. trichostachya*, all flowers are bisexual. In many other species of this section, they are gynomonoecious, that is, with female flowers and bisexual flowers on the same plant (e.g. *P. mollis*). In these cases, the female flowers can be distinguished by the absent or rudimentary

(and non-functional) anthers. In other species (e.g. *P. gigandra*), female flowers and bisexual flowers occur in separate plants (gynodioecious), with fruits forming from both flower types. One species treated here, *P. rupestris*, is dioecious, with separate male and female plants in roughly equal proportion; the style in the male flowers is non-functional, and fruits do not form.

6. Seeds

The seeds of all species in this section are very similar, being ovoid-conical in shape and black in colour. Threlfall (1983) advocated the use of surface patterning to distinguish the various species. The present author finds that the differences in seed surface patterns are quite useful for distinguishing groups of species, such as the colliculate surface present in the *P. sericostachya* group. However, differences in seed surface features between individual species are often negligible. There are however, considerable differences between some species in the length of the seeds. For example, the seeds of *P. latifolia* (4.6–4.8 mm long) are considerably longer than the related *P. altior* (3.3–3.4 mm long).

Identification

A dichotomous key to the identification of all (not just for the section *Epallage*) Queensland *Pimelea* species is presented. Following the reduction of *Thecanthes* Wikstr. into *Pimelea* (Foster *et al.* 2016), two species formerly classified under *Thecanthes* (*P. sanguinea* F.Muell., *P. cornucopiae* Vahl) are included in the key.

Taxonomy

Pimelea section **Epallage** (Endl.) Benth., *Fl. Austral.* 6: 30 (1873); *Epallage* Endl., *Gen. Pl.* 331 (1837); *Calyptrostegia* [infragen. unranked] *Epallage* C.A.Mey., *Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Pétersbourg* ser. 2, 4(4–5): 74 (1845); *Pimelea* subsection *Epallage* (Endl.) Meisn. in DC., *Prodr.* 14: 511 (1857); *Banksia* sect. *Epallage* (Endl.) Kuntze, *Lex. Gen. Phan.* 60 (1903). **Type:** *P. curviflora* R.Br., (lecto: *fide* Threlfall 1983: 170).

Stems hairy. Leaves simple, entire, hairy at least on abaxial surface, node buttresses absent. Inflorescence terminal, axillary or lateral; flowers densely clustered on an ellipsoidal or globose receptacle, or borne along an elongate rachis, sometimes clustered but often well-spaced and not touching each other. Rachis ± same width as peduncle. Floral tube usually circumscissile above the ovary. Anther connective broad, anther dehiscence introrse. Ovary with erect hairs distally. Fruits dry.

30 species endemic to Australia, 21 species in Queensland.

1. Pimelea altior F.Muell., *Fragm.* 1: 84 (1859); *Banksia altior* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 583 (1891); *P. altior* var. *typica* Domin, *Biblioth. Bot.* 89: 436 (1928), *nom. illeg.*; *P. latifolia* subsp. *altior* (F.Muell.) Threlfall, *Brunonia* 5: 193 (1983); *P. latifolia* var. *altior* (F.Muell.) Threlfall, *Brunonia* 5: 193 (1983). **Type:** Queensland. Moreton District: Moreton Bay, July 1855, *F. Mueller s.n.* (lecto [here designated]: MEL 50362; isolecto: K 000900026).

Pimelea altior var. *parvifolia* Domin, *Biblioth. Bot.* 89: 436 (1928); *P. latifolia* var. *parvifolia* (Domin) Threlfall, *Brunonia* 5: 193 (1983). **Type:** Queensland. Moreton District: Ithaca Creek, January 1910, *C.T. White s.n.* (holo: PR *n.v.*; iso: BRI [AQ23514]).

***Illustration*:** Leiper *et al.* (2008: 194), as *P. latifolia* subsp. *altior*.

Perennial shrub, 90–140 cm high, bisexual. Young stems densely hairy, longest hairs 0.6–1.3 mm long, spreading, slender, white and opaque. Leaves opposite to sub-opposite, disjunction between leaf pairs 0–4 mm, internodes 15–28 mm long; petioles 1–1.7 mm long. Lamina elliptical to broadly elliptical, 14–38 mm long, 8–14 mm wide, 1.8–2.9 times longer than wide, midrib visible, lateral veins sometimes visible; apex obtuse, mucronate; margins flat. Upper surface of lamina moderately densely hairy; hairs slender, longest 0.5–1 mm long, *c.* 0.025 mm wide, patent. Lower surface of lamina moderately densely hairy; hairs antrorse to patent, slender, not shiny, white,

longest hairs 0.5–1.3 mm long, *c.* 0.025 mm wide. Inflorescence terminal, capitulate, with 4–7 flowers produced (= number of persistent pedicels), partly enclosed by four leafy bracts, two short and two rather longer. Rachis globose, at maturity *c.* 1 mm long, densely hairy; peduncle length 0–1 mm long. Flowers all bisexual. Pedicels 0.4–0.5 mm long. Floral tube 5.2–8.2 mm long at anthesis, white; outer surface with hairs sparse to moderately dense, patent, longer ones 0.3–0.4 mm long; inner surface sparsely hairy. Sepals erect, 0.9–1.6 mm long, apex obtuse, inner surface glabrous, outer surface densely hairy. Staminal filaments *c.* 0.05 mm long; anthers 0.8–1.2 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 3.3–3.4 mm long, black, surface ± smooth or very finely foveolate. **Fig. 1A.**

***Additional selected specimens examined*: Queensland.** Port Curtis District: SF 67, Bulburin, Sep 1985, *Gibson 776* (BRI); Blackmans Creek, N of Blackmans Gap, 18 km SW of Miriam Vale, Oct 1995, *Brushe JB252 & Brushe* (BRI). Burnett District: Just off Q-traverse, Gallangowan SF, NNW of Jimna, Feb 2009, *Bean 28599* (BRI, CANB). Wide Bay District: Upper reaches of Broken Creek, SE of Builyan, Sep 1995, *Bean 8944 & Robins* (BRI, MEL); East branch of Stony Creek, 1.3 km SSW of Mt Walsh, Mt Walsh NP, May 2008, *Young 2359* (BRI); Noosa Bay, *s.dat., Eaves s.n.* (MEL 2181371); Conondale Range, Sep 1980, *Dillewaard 176 & Olsen* (BRI); Dog Grass Road, Mapleton SF, N of Mapleton, Apr 1993, *Bean 5952* (BRI). Moreton District: Stable Camp, Yarraman SF, Nov 1987, *Forster PIF3228 et al.* (BRI); Palmwoods, May 1907, *White s.n.* (BRI [AQ108716]); Archers Creek, brush under the mountain, Dec 1843, *Leichhardt s.n.* (MEL 50350); Kiamba, May 1959, *Thorne 21207 et al.* (BRI, CANB); Bellthorpe SF, Beacon Road, *c.* 18 km NW of Woodford, May 1984, *Sharpe 3550* (BRI); End of Regent Road, near Esk – Hampton Road, Oct 2015, *Bean 32422* (AD, BRI, CANB, MEL); Fifteen Mile Creek, 10 km NE of Toowoomba, near Murphy's Creek, Oct 1973, *Telford 3494* (BRI, CANB, NSW); Neurum Creek camping area, Mt Mee SF, Aug 2009, *Bean 29076* (BRI, CANB, MO, NSW); D'Aguilar Range, NW of Brisbane, Jun 1974, *Moriarty 1533* (BRI, CANB); Mt O'Reilly [W of Samford], Aug 1938, *Goy & Smith 517* (BRI); Just S of tower, Camp Mountain, WNW of Brisbane, Mar 2013, *Bean 32119* (BRI, MEL, NSW); One Tree Hill, Aug 1887, *Simmonds s.n.* (BRI [AQ108723]); Brisbane River, Jul 1874, *Bailey s.n.* (BRI [AQ108718]); Moreton Bay, 1872, *Eaves s.n.* (MEL 51283); Banks of Logan River, foot of Mt Ernest, Oct 1932, *Blake 4290* (BRI).

***Distribution and habitat*:** *Pimelea altior* is common in the south-east corner of Queensland, from the New South Wales border to Eumundi, with disjunct occurrences further north at Mt Walsh, and mountainous areas near Builyan (**Map 1**). In New South Wales, it extends as far south as Taree. It inhabits wet sclerophyll forest with tall *Eucalyptus* spp. and *Syncarpia glomulifera* (Sm.) Nied., or sometimes on the margins of rainforest. Soils are sandy-loams, loams, or red earths.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Typification*:** The specimen chosen here as the lectotype of the name *Pimelea altior* bears a label in Mueller's hand which reads (in part) 'in collibus petraeis', a phrase which is repeated in the protologue. The specimen matches the description given in the protologue very well. Walter Hill's name appears as co-collector in the protologue, but labelling on neither the lectotype nor the isolectotype mentions him.

***Notes*:** *Pimelea altior* is readily distinguishable from *P. latifolia sens. str.* and is formally reinstated to species rank here. It differs from *P. latifolia* by the opposite to sub-opposite leaves (alternate for *P. latifolia*); the leaves elliptic to broadly elliptic (obovate for *P. latifolia*); laminae 14–38 × 8–14 mm (31–67 × 13–24 mm for *P. latifolia*); the hairs moderately dense on the upper leaf surface (absent, or very sparse to sparse for *P. latifolia*); the rachis globose and *c.* 1 mm long (rachis ellipsoidal to cylindrical and 5–27 mm long for *P. latifolia*); the peduncles 0–1 mm long (2–6 mm long for *P. latifolia*); the sepals 0.9–1.6 mm long (1.6–2.3 mm long for *P. latifolia*); and the inner surface of the floral tube sparsely hairy (glabrous for *P. latifolia*).

Specimens from the Yarraman – Blackbutt area of south-east Queensland (e.g. *Forster PIF3228 et al.*, BRI) differ from the typical form by the longer, narrower leaves, the relatively short, sparse hairs on the upper leaf surface, and the greater number of flowers per inflorescence.

***Conservation status*:** *Pimelea altior* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

Fig. 1. A. ***Pimelea altior***. Mt Glorious (no voucher). Photo: J. Newland & R. Fryer. B. ***P. chlorina*** (*Bean 28851 & Jensen*, BRI). Photo: A.R. Bean. C. ***P. latifolia***. Scawfell Island (no voucher). Photo: H. Nicholson. D. ***P. confertiflora***. Irvinebank (no voucher). Photo: J. Newland & R. Fryer. E. ***P. fugiens*** (*Bean 28739*, BRI). Photo: A.R. Bean.

2. Pimelea amabilis (Domin) A.R.Bean **comb. et stat. nov.**; *Pimelea sericostachya* var. *amabilis* Domin, *Biblioth. Bot.* 89: 435 (1928); *P. sericostachya* subsp. *amabilis* (Domin) Threlfall, *Brunonia* 5: 150 (1983). **Type:** Queensland. Cook District: At the foot of the second calcifar karst hill in Chillagoe, February 1910, *K. Domin s.n.* (lecto: PR 529469, *fide* Threlfall 1983: 150).

***Illustrations*:** Domin (1928: 435, fig. 169), as *P. sericostachya* var. *amabilis;* Rye (1990: 162), as *P. sericostachya* subsp. *amabilis.*

Perennial shrub, 50–100 cm high, gynomonoecious. Young stems densely hairy, longest hairs 1.3–2.3 mm long, slender, white and opaque, appressed. Leaves often sub-opposite to opposite, disjunction between leaf pairs 0–5 mm, or sometimes alternate, with no discernible leaf pairs, internodes 10–25 mm long; petioles 0.3–1 mm long. Lamina narrowly-elliptic or elliptic, 20–36 mm long, 4–11 mm wide, 2.4–5.3 times longer than wide, with no veins visible or only midrib visible, apex acute, margins flat. Upper surface of lamina hairy; hairs slender, longest ones 0.7–1.5 mm long, *c.* 0.03 mm wide, appressed; dense to very dense. Lower surface of lamina hairy; hairs appressed, slender, shining, transparent, longest hairs 0.8–2 mm long, *c.* 0.03 mm wide, dense to very dense. Inflorescence terminal, spicate, with 75–250 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis cylindrical, at maturity 17–70 mm long, very densely hairy; peduncle length 10–29 mm long. Flowers bisexual or female. Pedicels 30–40 per cm of rachis, each 0.2–0.4 mm long. Floral tube 4.5–6.2 mm long at anthesis, yellow-green or yellow; outer surface with hairs very dense, antrorse, 0.7–1.6 mm long; inner surface glabrous. Sepals erect, 0.6–1.3 mm long, apex obtuse, inner surface glabrous, outer surface very densely hairy. Staminal filaments 0.05–0.1 mm long; anthers 1–1.1 mm long, dehiscence introrse. Style not or scarcely exserted. Fruit orientation at right angles to rachis. Seed ovoid, 3.7–4.2 mm long, dark brown, surface colliculate.

***Additional selected specimens examined*: Queensland.** Cook District: NE escarpment of Hann Tableland, *c.* 33 km NW of Mareeba, Apr 2013, *Mathieson MTM1531* (BRI); Boyle Creek, NW of Mareeba, Apr 1962, *McKee 9144* (BRI, CANB); Blackdown Road, 12 miles [19 km] from Station, Jan 1971, *MacDonald 2* (BRI); Stannary Hills area, *c.* 7 km S of Mutchilba, Aug 1979, *Clarkson 2507 & Byrnes* (BRI); 9 km from Mutchilba on road to Irvinebank via Stannary Hills, Jan 1982, *Clarkson 4232B* (BRI, CNS, K, MO, NT, PERTH); Stannary Hills, Jun 1908, *Bancroft s.n.* (BRI [AQ 97876]); 2.5 km from Lappa on Petford Road, Feb 1996, *Forster PIF18566 & Ryan* (BRI, CNS); *c.* 2.5 km by road E of Almaden, Jan 2005, *McDonald KRM3505* (BRI); junction of roads to Chillagoe and Ootan, 3 km W of Almaden, May 2003, *McKenzie RAM03/25* (BRI); Almaden, *s.dat.*, *Bick s.n.* (BRI [AQ730927]); Leaf Gold Weir road, 10 km W of Dimbulah, Apr 2001, *Sharp 323 et al.* (BRI); Bismark Range, E of Almaden, Jan 2011, *McDonald KRM10464* (BRI, DNA). North Kennedy District: 30 km SW of Mt Garnet, Apr 2002, *Bean 18916* (BRI, MEL).

***Distribution and habitat*:** *Pimelea amabilis* is endemic to north Queensland where it has a limited distribution from Hann Tableland (NW of Mareeba) to 30 km SW of Mt Garnet. It has been frequently collected around Almaden and Stannary Hills. There is an outlying population on Blackdown Station west of Chillagoe (**Map 2**). It inhabits skeletal soil on rocky outcrops of granite or rhyolite, although the type collection was reputedly made from a limestone outcrop.

***Phenology*:** Flowers and fruits are recorded from January to August.

***Notes*:** *Pimelea amabilis* differs from the related *P. confertiflora* by the longer hairs (0.7–1.5 mm long) of the upper leaf surface, with the hairs white or silvery, the often broader leaves (4–11 mm wide), and the shorter anthers (1–1.1 mm long). These species have separate though adjoining distributions; they apparently grow together only in the Stannary Hills area.

The intensely silvery leaves of *P. amabilis* are very beautiful, and the species deserves to be brought into cultivation.

***Conservation status*:** *Pimelea amabilis* is a common species. A conservation status of **Least Concern** is recommended (IUCN 2012).

3. Pimelea approximans A.R.Bean **sp. nov.** with affinity to *P. amabilis*, but differing by the antrorse villous hairs of the upper leaf surface, the longer strigose hairs on the lower leaf surface, the acute sepals, and the longer anthers and seeds. **Typus:** Queensland. Cook District: Ninian Bay, 14 May 1979, *J.A. Elsol 771 & T.D. Stanley* (holo: BRI; iso: CANB).

Perennial shrub, 50–60 cm high, gynomonoecious. Young stems densely hairy, longest hairs 1.8–2.5 mm long, coarse, shiny and transparent, appressed. Leaves sub-opposite to opposite (disjunction between leaf pairs 0–3 mm), or alternate, internodes 8–22 mm long; petioles 1.5–1.8 mm long. Lamina elliptic, 23–35 mm long, 5–11 mm wide, 2.7–4.6 times longer than wide, with only midrib visible, apex acute, margins flat. Upper surface of lamina glabrous or hairy; hairs slender, longest ones 0.6–1.1 mm long, *c.* 0.025 mm wide, antrorse; very sparse to moderately dense. Lower surface of lamina hairy; hairs appressed or antrorse, coarse, shining, transparent, longest hairs 2.2–2.7 mm long, *c.* 0.05 mm wide, sparse to moderately dense. Inflorescence terminal, spicate, with 50–130 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis cylindrical, at maturity 21–50 mm long, very densely hairy; peduncle length 10–28 mm long. Flowers bisexual or female. Pedicels 20–40 per cm of rachis, each 0.2–0.4 mm long. Floral tube 4.5–4.8 mm long at anthesis, yellow; outer surface with hairs dense, antrorse, 1.3–1.9 mm long; inner surface glabrous. Sepals erect, 1.2–1.8 mm long, apex acute, inner surface glabrous, outer surface densely hairy. Staminal filaments *c.* 0.05 mm long; anthers 1.2–1.4 mm long, dehiscence introrse. Style not or scarcely exserted. Fruit orientation at right angles to rachis. Seed ovoid, 3.9–4.5 mm long, dark brown, surface colliculate. **Fig. 2.**

***Additional specimens examined*: Queensland.** Cook District: Top of mountain near Coen River, 1891, *Johnson s.n.* (MEL 2182365); Upper Stuart River, 1891, *Johnson s.n.* (MEL 2182366); sources of the South Coen River, 1891, *Johnson s.n.* (CANB 250141, MEL 2182364); Stanley Island, Jun 1995, *Le Cussan 605* (BRI).

***Distribution and habitat*:** *Pimelea approximans* is endemic to north Queensland where it is known from the Bathurst Bay area and the Coen area of Cape York Peninsula (**Map 2**). It occurs in woodland or grassland on rocky hillsides.

***Phenology*:** Flowers and fruits are recorded for May and June.

***Affinities*:** *Pimelea approximans* has affinity with *P. amabilis*. The leaves and the inflorescence rachis are similar in size and shape. However, it differs from *P. amabilis* in a number of characteristics: *P. approximans* has hairs absent or very sparse to moderately dense on the upper leaf surface (versus dense to very dense for *P. amabilis*); the hairs on the lower leaf surface are thicker, sparse to moderately dense, 2.2–2.7 mm long (versus thin, dense to very dense, 0.8–2 mm long for *P. amabilis*); the sepals are acute, and the anthers are 1.2–1.4 mm long (versus sepals obtuse, anthers 1.–1.1 mm long for *P. amabilis*).

***Conservation status*:** *Pimelea approximans* is known from three subpopulations with an estimated area of occupancy of 3 km^2. No subpopulations are known to be directly threatened. Applying the Red List criteria (IUCN 2012), a conservation status of **Vulnerable** is recommended (criterion D2).

***Etymology*:** The epithet is from the Latin *approximans*, meaning 'approaching, approximating'. This is in reference to the morphological affinity between this species and *P. amabilis*.

4. Pimelea aquilonia Rye, *Fl. Australia* 18: 323 (1990). **Type:** Queensland. Cook District: Newcastle Bay, 2.5 miles [4 km] S of Somerset homestead, Cape York Peninsula, 11 May 1948, *L.J. Brass 18769* (holo: BRI; iso: A).

***Illustration*:** Rye (1990: 171).

Perennial shrub, 60–300 cm high, gynomonoecious. Young stems densely hairy, longest hairs 0.25–0.5 mm long, thick, shiny and transparent, antrorse. Leaves strictly opposite, internodes 1–7 mm long; petioles 0.4–1.1 mm long. Lamina narrowly elliptic to elliptic, 11–31 mm long, 2–6 mm wide, 4.2–7.3 times longer than wide, midrib visible, lateral veins sometimes faintly visible; apex

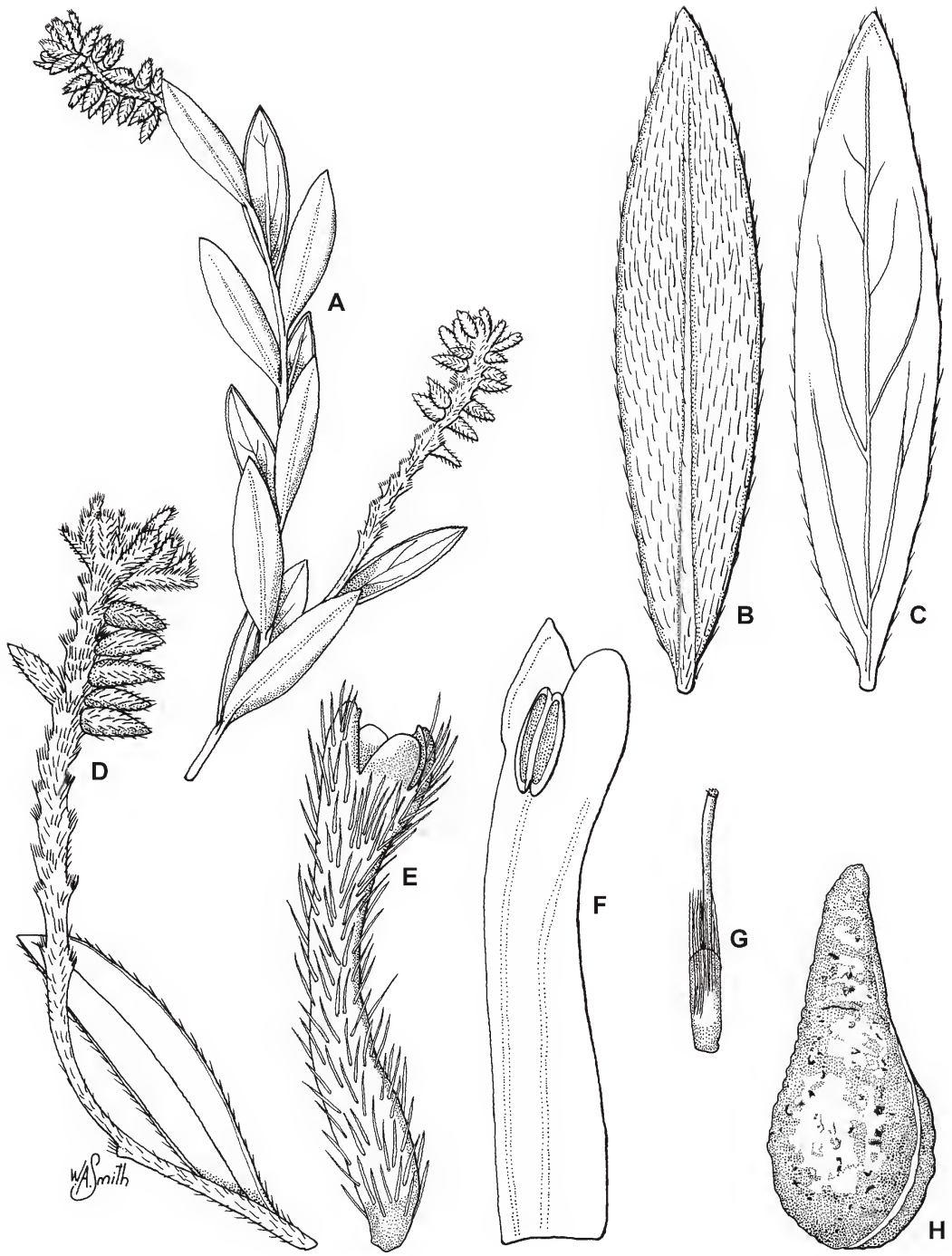

Fig. 2. ***Pimelea approximans***. A. flowering branchlet ×1. B. upper leaf surface ×3. C. lower leaf surface ×3. D. old inflorescence, where many flowers and fruits have abscised ×2. E. floral tube and sepals ×10. F. half flower ×12. G. ovary and style ×12. H. seed ×12. A–D, H from *Le Cussan 605* (BRI); E–G from *Elsol 771 & Stanley* (BRI). Del. W. Smith.

acute; margins flat. Upper surface of lamina glabrous. Lower surface of lamina hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 0.2–0.3 mm long, *c.* 0.025 mm wide, sparse. Inflorescence terminal, capitulate, with 3–4 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis globular, at maturity 1–2 mm long, densely hairy; peduncle length 0–2 mm long. Some flowers bisexual, some female. Pedicels 0.5–0.7 mm long. Floral tube 9.7–12 mm long at anthesis, white; outer surface with hairs dense, appressed, longer ones 0.3–0.4 mm long; inner surface hairy. Sepals widely spreading, 2.4–4.2 mm long, apex acute, inner surface glabrous, outer surface densely hairy. Staminal filaments *c.* 0.05 mm long; anthers 2.3–2.5 mm long, dehiscence introrse. Style not or scarcely exserted. Seeds not seen.

***Additional selected specimens examined*: Queensland.** Cook District: N of Jardine River, *c.* 32 km NE of Bamaga, Oct 1971, *Dodson s.n.* (BRI [AQ3634]); Heathlands, road to Captain Billy beyond junction, May 1980, *Morton 627* (BRI); SE of Conical Hill, 4 km SE of Shelburne Bay, 3 km W of Thorpe Point, Jun 2008, *Forster PIF33778 et al.* (BRI, NSW); Shelburne Bay, May 1991, *Spencer s.n.* (BRI [AQ506113]); 6.5 km from Captain Billy Landing, Jun 1994, *Forster PIF15363* (BRI, CNS); 15 km N of Middle Peak road junction, Mar 1992, *Johnson 5115* (AD, BRI, MEL, NSW); 0.8 km N of Captain Billy Landing, Mar 1992, *Clarkson 9271 & Neldner* (BRI, DNA, K, MEL); Bolt Head, Jul 1990, *Clarkson 8772 & Neldner* (BRI, CNS, DNA, K, L); Temple Bay, Bolt Head, Jun 1996, *Forster PIF19362* (BRI); Shelburne holdings, near Harmer Creek boat launching site, Nov 1984, *Gunness AG1914* (BRI); Lake Wicheura, Cape York, Jun 1985, *Thiele 909* (BRI, CANB); Sharp Point, Jun 1978, *Clarkson 2108* (BRI); Upper reaches of Escape River, Jun 1978, *Clarkson 2055* (BRI); Richardson Range, 19 km along Middle Peak track to Shelburne Bay, Jun 2008, *Forster PIF33677 & McDonald* (BRI, NSW); Temple Bay, *c.* 4 km NW of Glennie Inlet, Jun 1978, *Clarkson 2171* (BRI); eastern slopes of Mt Pieter Botte, July 1983, *Godwin C2471* (BRI).

***Distribution and habitat*:** *Pimelea aquilonia* is endemic to north Queensland. Its distribution extends from Somerset (near the tip of Cape York Peninsula) to Bolt Head and Temple Bay, about 200 km to the south. There is also a highly disjunct occurrence at Mt Pieter Botte north of Daintree (see note below) (**Map 2**). It grows on sand dunes close to the coast, in *Thryptomene* shrubland or in fragmented rainforest with hoop pine and/or *Callitris*. In the case of Mt Pieter Botte, it occurs in granite crevices.

***Phenology*:** Flowers and fruits have been recorded for most months of the year.

***Affinities*:** *Pimelea aquilonia* and *P. umbratica* are the only Queensland species with strictly opposite leaves. *P. aquilonia* differs from *P. umbratica* by the antrorse stem hairs (appressed for *P. umbratica*), the 3–4 flowers per inflorescence (8–14 for *P. umbratica*), the floral tube 9.7–12 mm long (4.2–6.8 mm for *P. umbratica*), the obtuse sepal apex (acute for *P. umbratica*), and the anthers 2.3–2.5 mm long (1.4–1.8 mm long for *P. umbratica*).

***Note*:** There is some doubt about the provenance of the Godwin collection reputedly from Mt Pieter Botte, as the number given on the label (C2471) does not match the number on the tag attached to the specimen (C2470). The specimen is undoubtedly *P. aquilonia*, but perhaps it was collected from northern Cape York Peninsula.

***Conservation status*:** *Pimelea aquilonia* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

5. Pimelea chlorina A.R.Bean **sp. nov.,** distinguished by the alternate leaves, the inflorescences borne laterally on the stem, the long silky hairs on the stems and leaves, and the bisexual greenish-yellow flowers. **Typus:** Queensland. North Kennedy District: 0.8 km east of Taravale homestead, south-west of Paluma, 15 May 2009, *A.R. Bean 28851 & R. Jensen* (holo: BRI; iso: CANB, MEL, NSW, *distribuendi*).

Pimelea sp. (Bakers Blue Mt D.G.Fell DF1588); Bean (2016).

Perennial shrub, 50–150 cm high, bisexual. Young stems densely hairy, longest hairs 1.4–2.4 mm long, slender, somewhat shiny and transparent, antrorse to spreading. Leaves alternate, internodes 3–12 mm long; petioles 0.8–1.4 mm long. Lamina elliptic, obovate or broadly elliptic, 12–26 mm long, 4.5–11.5 mm wide, 1.8–3.2 times longer than wide, midrib visible, lateral veins not visible; apex

acute; margins flat. Upper surface of lamina consistently hairy; hairs slender, longest ones 0.7–2 mm long, *c.* 0.025 mm wide, appressed, antrorse or patent; moderately dense to dense. Lower surface of lamina hairy; hairs appressed, antrorse or patent, slender, somewhat shiny, transparent, longest hairs 1.7–2.5 mm long, *c.* 0.025 mm wide, moderately dense to dense. Inflorescence lateral, with 15–45 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis ellipsoidal or cylindrical, at maturity 3–9 mm long, very densely hairy; peduncle length 0–1.5 mm long. Flowers bisexual. Pedicels 0.7–0.8 mm long. Floral tube 4.3–6 mm long at anthesis, greenish-yellow; outer surface with hairs dense, appressed, longer ones 0.5–1.3 mm long; inner surface glabrous. Sepals at 45 degrees or erect, 1–1.6 mm long, apex obtuse, inner surface glabrous, outer surface densely hairy. Staminal filaments *c.* 0.05 mm long; anthers 0.9–1 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 3.4–3.8 mm long, black, surface foveolate. **Figs. 1B, 3.**

***Additional specimens examined*: Queensland.** Cook District: Bakers Blue Mt, Font Hills Station, 19 km S of Mt Carbine, Jan 1989, *Fell DF1588* (BRI); Bakers Blue Mt, Font Hills, Feb 1996, *Gray 6624* (BRI, CNS); Herberton Range, between Atherton and Herberton, May 1995, *Jago 3430* (BRI). North Kennedy District: Above Return Creek falls, Taravale, NW of Townsville, May 2009, *Bean 28870 & Jensen* (AD, BRI); Return Creek Gorge, *c.* 8.4 km SSE of Taravale homestead on Mt Zero/Taravale Wildlife Sanctuary, May 2012, *Jensen 2595* (BRI); 17.1 km W of Paluma towards Hidden Valley, Nov 2000, *Jackes 2073* (BRI); Three Mile Creek Falls, Kallanda Station, Apr 2001, *Pollock ABP994 & Turpin* (BRI); 17.7 km N of Greenvale Railway on Ewan – Laroona Road, Jan 1999, *Cumming 18239* (BRI); Blencoe Falls lookout (west side), Jun 1996, *Cumming 14837* (BRI); Hidden Valley, W of Paluma, Apr 1996, *Forster PIF18973 & Ryan* (BRI, MEL); Taravale near Hell Hole Creek, 0.5–1.5 km E of homestead, Mar 1987, *Jackes 8756* (BRI); W of Mt Spec, Jul 1975, *Jackes s.n.* (BRI [AQ195443]); 21 km W of Paluma towards Hidden Valley, Dec 1976, *Jackes s.n.* (BRI [AQ195444]); 16 km SSW of Myola homestead, 84 km W of Charters Towers, Aug 1992, *Thompson HUG39 & Sharpe* (BRI); Mingela Bluff, Maidavale, E of Mingela, Apr 1991, *Bean 2970* (BRI, MEL, PERTH).

***Distribution and habitat*:** *Pimelea chlorina* is endemic to north Queensland where it is sporadically distributed from Mt Carbine to Charters Towers (**Map 3**). It grows in sandy soils usually derived from granite, either on hillsides or associated alluvials, but at Mingela Bluff, it inhabits hillsides composed of quartzose sandstone.

***Phenology*:** Flowers and fruits have been recorded for all months of the year except September and October.

***Affinities*:** *Pimelea chlorina* is not apparently closely related to any other species. It is distinctive by virtue of the lateral inflorescences, comprising 15–45 greenish-yellow flowers, and the short, broad, rather silvery leaves. It is reminiscent of *P. latifolia*, but *P. chlorina* differs by the lateral inflorescences, the bisexual flowers, the yellow-green floral tube, and the smaller leaves with long hairs.

***Conservation status*:** *Pimelea chlorina* is known from ten subpopulations with an estimated area of occupancy of 10 km^2. Most subpopulations are either in conservation reserves or in areas unlikely to be cleared of vegetation. However, there is a threat from weed encroachment, particularly the invasive *Praxelis clematidea* (Griseb.) R.M.King & H.Rob. It is considered that this species does not meet the Red List criteria for Vulnerable (IUCN 2012), but it may do in the near future, and a conservation status of **Near Threatened** is recommended.

***Etymology*:** The specific epithet is derived from the Greek *chloros* meaning pale green or greenish-yellow, and refers to the flowers that are greenish-yellow.

6. Pimelea confertiflora A.R.Bean **sp. nov.,** with affinity to *P. amabilis*, but differing by the short antrorse hairs on the upper leaf surface, the thick strigose hairs of the lower leaf surface, the longer anthers and the longer staminal filaments. **Typus:** Queensland. Cook District: Mount Misery, 7 km from Irvinebank, on road to Silver Valley, 24 February 1990, *P.I. Forster PIF6271* (holo: BRI; iso: CANB, DNA).

Perennial shrub, 40–150 cm high, gynomonoecious. Young stems densely hairy, longest hairs 1.2–1.8 mm long, coarse, shiny and transparent, appressed. Leaves often sub-

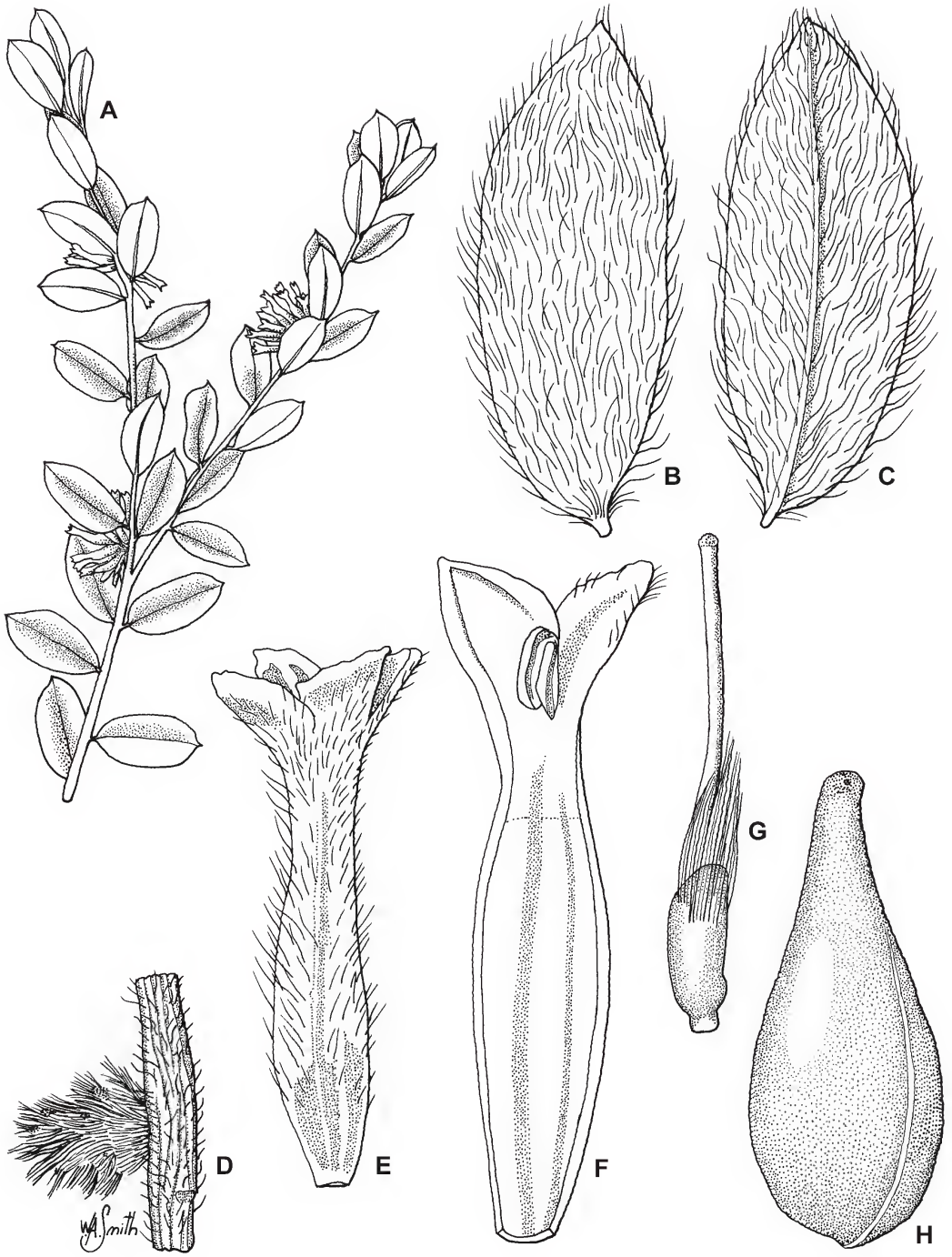

Fig. 3. ***Pimelea chlorina***. A. flowering branchlet ×1. B. upper leaf surface ×4. C. lower leaf surface ×4. D. old inflorescence, where all flowers and fruits have abscised ×4. E. floral tube and sepals ×10. F. half flower ×12. G. ovary and style ×12. H. seed ×16. All from *Bean 28851 & Jensen* (BRI). Del. W. Smith.

opposite to opposite (disjunction between leaf pairs 0–6 mm), or sometimes alternate, with no discernible leaf pairs, internodes 8–23 mm long; petioles 0.5–1.2 mm long. Lamina elliptic or narrowly-elliptic, 13–29 mm long, 2–6 mm wide, 3.7–9 times longer than wide, with no veins visible or only midrib visible, apex acute, margins flat. Upper surface of lamina hairy; hairs slender, longest ones 0.3–0.7 mm long, *c.* 0.025 mm wide, antrorse or patent; moderately dense to dense. Lower surface of lamina hairy; hairs appressed, coarse, shining, transparent, longest hairs 1.2–2.1 mm long, *c.* 0.05 mm wide, dense to very dense. Inflorescence terminal, spicate, with 52–130 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis cylindrical, at maturity 18–55 mm long, very densely hairy; peduncle length 2–30 mm long. Flowers bisexual or female. Pedicels 20–30 per cm of rachis, each 0.3–1 mm long. Floral tube 4.5–6.6 mm long at anthesis, yellow-green or yellow; outer surface with hairs very dense, antrorse, 0.9–1.2 mm long; inner surface glabrous. Sepals erect, 0.7–1.6 mm long, apex obtuse, inner surface glabrous, outer surface densely hairy. Staminal filaments 0.05–0.1 mm long; anthers 1.1–1.3 mm long, dehiscence introrse. Style not or scarcely exserted. Fruit orientation at right angles to rachis. Seed ovoid, 3.5–4.1 mm long, dark brown, surface verrucate. **Figs. 1C, 4.**

***Additional selected specimens examined*: Queensland.** Cook District: 35 km NW of Mt Carbine, Watershed Mine site, Apr 2008, *Wannan 5136* (BRI, NSW); Windsor Tableland NP, *c.* 35 km NNW of Mount Carbine, Apr 2013, *Mathieson MTM1448 & Forster* (BRI); *c.* 5 km N of Spencer Creek crossing on road to Windsor Tableland, May 1989, *Jones 4427 & Clemens* (BRI); Mt Windsor Tableland, 10 Sep 1980, *Hind 2747 & Forlonge* (BRI, NSW); *c.* 3 km SW along Bethels Crossing Road, adjacent to Mt Alto, 4 km WSW of Mt Carbine, Apr 2007, *Kemp JEK10126 & McKenna* (BRI); 5.2 km E of Davies Creek Road from Kennedy Highway, Aug 1993, *Neldner 4119* (BRI); Davies Creek forestry road, *c.* 15 miles [24 km] E of Mareeba, Aug 1963, *Schodde 3317* (BRI); 16 km NW of Mt Garnet, on road to Lappa, Jan 1993, *Bean 5476 & Forster* (BRI); Near granite gorge off Chewko Road, near Mareeba, Apr 1990, *van der Werff 11508* (BRI); Stannary Hills, 15.5 km S of Mutchilba, opposite Iona Mine, May 2006, *Forster PIF31696 & McDonald* (BRI); Mt Molloy, Apr 1932, *Brass 2467A* (BRI); The jump-up, between Carbeen and Turkinjee, *c.* 12 miles [19 km] N of Atherton, Apr 1953, *Melville 3718 et al.* (BRI); Mt Misery, near top of range, May 1979, *Clarkson 151* (BRI); Powerline track, 1.1 km N of Herberton – Irvinebank road, turnoff 5.8 km W of Herberton, May 2005, *Cumming 23205* (BRI); Undara western tunnel line, Mt Rosey, Nov 1989, *Godwin C3688* (BRI). North Kennedy District: Road to Baal Gammon mining area, W of Herberton, Jul 2004, *McDonald KRM2912 & Bean* (BRI); Road to Old Baal Gammon mine, off Herberton – Irvinebank Road, Mar 2004, *Sankowsky 2379 & Sankowsky* (BRI); Western firebreak, TR 245, near Ravenshoe, Jul 1999, *McDonald KRM32 et al.* (BRI); Road between Herberton and Watsonville, Jul 1967, *Brass 33608* (BRI); Herberton, Jan 1912, *Kenny s.n.* (BRI [AQ97870]); Evelyn Creek Conservation Park, W of Ravenshoe, Mar 2005, *McDonald KRM4190 & Winter* (BRI); Silver Valley Road, W of Ravenshoe, Apr 2005, *Forster PIF30723 & McDonald* (BRI).

***Distribution and habitat*:** *Pimelea confertiflora* is endemic to north Queensland occurring from Windsor Tableland (near Mt Carbine) to Undara NP (near Mt Surprise), and east to Davies Creek road, near Mareeba (**Map 3**). It inhabits hillsides with sandy or skeletal soil on rocky outcrops of granite or rhyolite.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Affinities*:** The name *Pimelea sericostachya* subsp. *sericostachya* has been widely misapplied to this species. *P. confertiflora* differs from *P. sericostachya* by the inflorescence rachis 18–55 mm long (63–250 mm long for *P. sericostachya*), 20–30 flowers per centimetre of rachis (4–8 per cm for *P. sericostachya*), and the much denser hairs on the lower leaf surface, rachis, floral tube and sepals.

***Conservation status*:** *Pimelea confertiflora* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

***Etymology*:** From the Latin *confertus* 'crowded' and *florus* 'flowers', referring to the flowers of this species that are crowded together on the rachis.

7. Pimelea curviflora R.Br., *Prodr.* 362 (1810). **Type:** New South Wales. Near Parramatta, June 1802, *R. Brown (Bennett No. 3186)* (holo: BM).

Fig. 4. ***Pimelea confertiflora***. A. flowering branchlet ×1. B. upper leaf surface ×3. C. lower leaf surface ×3. D. old inflorescence, where most flowers and fruits have abscised ×3. E. floral tube and sepals ×10. F. half flower ×12. G. ovary and style ×12. H. seed ×12. A–C from *Sankowsky 2379 & Sankowsky* (BRI); D from *Neldner 4119* (BRI); E–H from *McDonald KRM2912 & Bean* (BRI). Del. W. Smith.

Annual herb or perennial shrub, 20–45 cm high, gynomonoecious. Young stems sparsely to densely hairy, longest hairs 1.6–2.4 mm long, thick, shiny and transparent, antrorse. Leaves opposite to sub-opposite, disjunction between leaf pairs 0–4 mm, or sometimes alternate, internodes 7–27 mm long; petioles 0.8–1 mm long. Lamina oblanceolate, broadly-elliptic or elliptic, 12–20 mm long, 2.5–6 mm wide, 2.3–5.2 times longer than wide, with only the midrib visible, apex acute, margins flat. Upper surface of lamina glabrous. Lower surface of lamina hairy; hairs moderately dense, appressed to antrorse, thick, very shiny, transparent, longest hairs 1.6–2.2 mm long, *c.* 0.05 mm wide. Inflorescence terminal, capitulate, with 9–28 flowers produced (= number of persistent pedicels), partly enclosed by two or four leafy bracts. Rachis globose to ellipsoidal, at maturity 2–4 mm long, very densely hairy; peduncle length 0–1 mm long. Flowers a mixture of bisexual and female. Pedicels 0.3–0.5 mm long. Floral tube 4.6–6 mm long at anthesis, yellow; outer surface with hairs dense, appressed, 0.4–1.5 mm long; inner surface glabrous. Sepals erect, 1–2.5 mm long, apex obtuse, inner surface glabrous, outer surface densely hairy. Staminal filaments 0.05–0.1 mm long; anthers 1.2–1.3 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 2.8–2.9 mm long, black, surface foveolate.

Two varieties occur in Queensland, distinguished by the following key:

Longest leaf hairs 1.3–2.5 mm; flowers 5–15 per inflorescence . . **P. curviflora** var. **divergens**
Longest leaf hairs 0.6–1.0 mm; flowers 3–7 per inflorescence. . . . .**P. curviflora** var. **gracilis**

7a. Pimelea curviflora var. **divergens** Threlfall, *Brunonia* 5: 189 (1983). **Type:** New South Wales. Currububula District, 31 May 1940, *Glenfield Vet. Res. 40/812* (holo: NSW).

***Additional selected specimens examined*: Queensland.** Burnett District: Well Station Creek, *c.* 50 km SW of Mundubbera, Nov 2008, *Bean 28163 & Grimshaw* (BRI); Narayan Village, Mar 1973, *Hargreaves N1203* (BRI); Boyne River, *c.* 15 km W of Kingaroy, Oct 1954, *Johnson & Pedley s.n.* (BRI [AQ108793]); N of Bunya Mountains, 20 km N of Kumbia, Oct 1998, *Martin 99* (BRI); 6 km from Kumbia towards Bunya Mountains, Dec 1997, *Bean 12689* (BRI). Darling Downs District: SF98 (Bell – Jandowae), Dec 1984, *Specht 211* (BRI); Gowrie Junction, S of railway line, Oct 1999, *Bean 15616* (BRI); Wyreema, Mar 1931, *Hubbard 5893* (BRI); 2 miles [3 km] S of Pittsworth, Nov 1946, *Everist & Webb 1226* (BRI); Near Pilton, Oct 1954, *Everist s.n.* (BRI [AQ108788]); Near Swanfels, ENE of Warwick, Nov 1971, *Blake 23744A* (BRI); Glenlyon – Bonshaw Road, near Emu Park turnoff, Dec 1999, *Butler s.n.* (BRI [AQ492887]). Moreton District: 8 km W of Blackbutt, towards Yarraman, Nov 1996, *Bean 11397* (BRI); Mt Mistake, Jun 1887, *Simmonds s.n.* (BRI [AQ418743]).

***Distribution and habitat*:** *Pimelea curviflora* var. *divergens* occurs between Warwick and Mundubbera, with an apparent outlier near Bonshaw (**Map 4**). It also occurs in the north-western slopes region of New South Wales, south to around Tamworth. It inhabits hillsides with clay or clay-loam soils, usually derived from basalt.

***Phenology*:** Flowers and fruits are recorded mainly from October to December, and there is a single record from March.

***Notes*:** The specimens cited above are a very good match for the type of this variety. The Queensland specimens cited by Threlfall (1983) and Rye (1990) under the name *P. curviflora* var. *sericea* Benth. have been identified here as *P. curviflora* var. *divergens*. I could not find any Queensland specimens that match the type of *P. curviflora* var. *sericea*.

***Conservation status*:** *Pimelea curviflora* var. *divergens* is a common and widespread variety. A conservation status of **Least Concern** is recommended (IUCN 2012).

7b. Pimelea curviflora var. **gracilis** (R.Br.) Threlfall in Jessop & Toelken, *Fl. South Austral.* 4,4: 2147 (1986); *P. gracilis* R.Br., *Prodr.* 362 (1810). **Type:** [Tasmania] Western Arm, Port Dalrymple, 6 January 1804, *R. Brown (Bennett No. 3187)* (holo: BM, *fide* Threlfall 1983: 2147).

***Illustration*:** Leiper *et al.* (2008: 485).

***Additional selected specimens examined*: Queensland.** Darling Downs District: Hellhole Gorge, NE of Yangan, Oct 1996, *Bean 10941* (BRI, MEL); Near Swanfels, Nov 1971, *Blake 23744B* (BRI); Killarney, Oct 1891, *s. coll.* (BRI [AQ85861]). MORETON DISTRICT: Mt Mistake, Jun 1887, *Bailey s.n.* (BRI [AQ108794]); Mt Mistake, Nov 1930, *Hubbard 5218* (BRI); Mt Mistake, Apr 1939, *Blake 14005* (BRI, K, NSW).

***Distribution and habitat*:** In Queensland, *Pimelea curviflora* var. *gracilis* is confined to the vicinity of the Great Dividing Range, close to the New South Wales border (**Map 5**), but is otherwise widespread in New South Wales, Victoria, South Australia and Tasmania. Few Queensland specimens include habitat data, but it is recorded as growing "on edge of rainforest in rocky situations", "cliff faces in ecotone", and "on sandy soil over rhyolite, eucalypt woodland".

***Phenology*:** Flowers and fruits are recorded between April and November.

***Notes*:** The Queensland specimens cited above are not a particularly good match for the type of this variety, but they are maintained under this name merely for convenience until some future researcher completes a revision of the *P. curviflora* complex.

***Conservation status*:** *Pimelea curviflora* var. *gracilis* is a common and widespread variety. A conservation status of **Least Concern** is recommended (IUCN 2012).

8. Pimelea elongata Threlfall, *Telopea* 2: 55 (1980). **Type:** Queensland. Warrego District: Tributary of Beechel Creek, 3 miles [5 km] NW of Cheepie, 22 July 1970, *I. Clark s.n.* (holo: BRI [AQ24720]).

***Illustrations*:** Rye (1990: 162); Fletcher *et al.* (2009: 14, 15).

Annual forb, 15–40 cm high, bisexual. Young stems very sparsely hairy, longest hairs 0.3–0.6 mm long, slender, somewhat shiny and transparent, appressed to antrorse. Leaves alternate, internodes 1–14 mm long; petioles 0.5–0.6 mm long. Lamina narrowly-elliptic to oblanceolate, 7–15 mm long, 1.4–2.8 mm wide, 3.8–7.9 times longer than wide, with no veins visible, apex obtuse, margins flat. Upper surface of lamina glabrous. Lower surface of lamina glabrous or occasionally hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 0.3–0.5 mm long, *c.* 0.025 mm wide, very sparse. Inflorescence terminal, spicate, with 17–42 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis linear, at maturity 18–100 mm long, sparsely hairy; peduncle length 0–8 mm long. Flowers bisexual. Pedicels 3–6 per cm of rachis, each 0.5–0.9 mm long. Floral tube 2.4–3 mm long at anthesis, green-yellow to yellow, but obscured by white hairs; outer surface with a dense to very dense layer of short appressed hairs 0.3–0.5 mm long; inner surface glabrous. Sepals erect, 0.5–0.8 mm long, apex obtuse, inner surface glabrous, outer surface moderately densely hairy. Staminal filaments 0.1–0.2 mm long; anthers 0.3–0.6 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 2.3–2.5 mm long, black, surface foveolate.

***Additional selected specimens examined*: Queensland.** Gregory North District: Tonkoro Station, 2.4 km from Gun Creek well at bearing 337 degrees, Aug 2013, *Pennay CP545 & Richter* (BRI). Mitchell District: 12 km E of Jundah, 2 km W of Paradise house, Dec 2008, *Milson JM1735* (BRI); 20 km E of Trinidad homestead on road to Milo, Nov 2007, *Silcock Trinidad1 et al.* (BRI). Gregory South District: Kyabra Creek rest area, on the Quilpie – Windorah Road, Sep 2010, *Bean 30283* (BRI); 9 km NW of Eromanga, Feb 1972, *Kelly s.n.* (BRI [AQ1653]). Warrego District: 104 miles [167 km] from Charleville on Quilpie Road, Sep 1963, *Everist 7528* (BRI); 5 km S of Toompine on Toompine – Thargomindah Road, Sep 2009, *Silcock PP09/082* (BRI); 1 km E of Thurlgoona homestead on N side of creek, *c.* 75 km SSE of Cunnamulla, May 2008, *O'Sullivan PP08/159* (BRI); *c.* 27 km NE of Thargomindah on Quilpie Road, Sep 1973, *Henderson H2082 & Boyland* (BRI); 35 km W of Thargomindah, Sep 2005, *Batianoff & Butler 0509208* (BRI); Moombidary Station, *c.* 48 km W of Hungerford, Nov 1954, *Smith 6040* (BRI). Maranoa District: 2 km NW of Carellen homestead, *c.* 90 km WNW of Bollon, Mar 2008, *Bean 27451 & Wang* (BRI); 64 km E of Cunnamulla on Balonne Highway, Sep 2003, *McKenzie RAM03/188* (BRI); 7 km NE of South Plain, May 1977, *Purdie 616E* (BRI); Dingwall Station, *c.* 156 km SSE of Charleville, Apr 1952, *Everist 5006* (BRI); Murra Murra, on flat immediately E of homestead, SW Bollon, Feb 2007, *Eddie CPE1085* (BRI).

***Distribution and habitat*:** *Pimelea elongata* is widespread in southern inland Queensland as far east as Bollon, and as far north as Vergemont (W of Longreach), but apparently absent from far south-western Queensland (**Map 5**). It also extends to far northern parts

of New South Wales. It grows along drainage lines or in the bed of ephemeral lakes, in clay or clay-loam soil. The vegetation community is often grassland, but it sometimes grows with *Eucalyptus coolabah* Blakely & Jacobs, *E. populnea* F.Muell. or *Acacia aneura* F.Muell. ex Benth.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Notes*:** *Pimelea elongata* is distinguished by its annual habit, leaves without visible venation and very sparsely hairy on the lower surface, the sparsely hairy linear rachises, the floral tube only 2.4–3 mm long at anthesis, and the anthers 0.3–0.6 mm long.

***Conservation status*:** *Pimelea elongata* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

9. Pimelea fugiens A.R.Bean **sp. nov.** with affinity to *P. strigosa*, but differing by the opposite or sub-opposite leaves, the shorter sepals, and the shorter hairs on the stems and the floral tube. **Typus:** Queensland. Port Curtis District: Thangool – Lookerbie Road, S of Thangool, 9 May 2009, *A.R. Bean 28739* (holo: BRI; iso: CANB, MEL, MO, NSW, P, *distribuendi*).

Perennial shrub, 30–40 cm high, bisexual. Young stems sparsely hairy, longest hairs 0.6–0.8 mm long, slender, somewhat shiny and transparent, appressed. Leaves opposite or sub-opposite, disjunction between leaf pairs 0–3 mm, internodes 9–25 mm long; petioles 0.7–1.2 mm long. Lamina elliptic, 15–33 mm long, 5–12 mm wide, 2.2–3.5 times longer than wide, midrib visible, lateral veins sometimes visible; apex acute, margins recurved. Upper surface of lamina glabrous or sometimes with a few hairs on midrib; hairs slender, longest ones 0.2–0.4 mm long, *c.* 0.02 mm wide, appressed; very sparse. Lower surface of lamina hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 0.5–0.6 mm long, *c.* 0.02 mm wide, sparse. Inflorescence terminal or axillary, capitulate, with 12–18 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis globose to ellipsoidal, at maturity 2–4 mm long, very densely hairy; peduncle length 8–28 mm long. Flowers bisexual. Pedicels 0.2–0.4 mm long. Floral tube 3.6–4.6 mm long at anthesis, pale yellow; outer surface with hairs dense, appressed, 0.4–0.5 mm long; inner surface glabrous. Sepals erect, 0.9–1.3 mm long, apex obtuse, inner surface glabrous, outer surface moderately densely hairy. Staminal filaments 0–0.05 mm long; anthers 0.6–0.75 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, *c.* 3.3 mm long, black, surface ± smooth. **Figs. 1D, 5.**

***Additional specimens examined*: Queensland.** Port Curtis District: Lookerbie road, *c.* 13 km S of Thangool, Apr 1996, *Bean 10252 & Turpin* (BRI); Dry Creek, Portion 3 Clifford, 29 km E of Biloela, Oct 1993, *Brushe 43 & Hoy* (BRI).

***Distribution and habitat*:** *Pimelea fugiens* is endemic to central Queensland and known only from two sites in the Biloela district (**Map 6**). It grows along dry gullies dominated by *Melaleuca bracteata* F.Muell., with other associated species including *Eucalyptus tereticornis* Sm. subsp. *tereticornis*, *Corymbia tessellaris* (F.Muell.) K.D.Hill & L.A.S.Johnson and *Pleiogynium timorense* (DC.) Leenh. and with introduced weeds *Dolichandra unguis-cati* (L.) L.G.Lohmann and *Lantana montevidensis* (Spreng.) Briq. The soil is brown clay with much stone.

***Phenology*:** Flowers and fruits are recorded for April, May and October.

***Affinities*:** *Pimelea fugiens* is apparently closely related to *P. strigosa*, but differs by the longest stem hairs 0.6–0.8 mm long (1.2–1.7 mm long in *P. strigosa*), the leaves opposite to sub-opposite (mostly alternate in *P. strigosa*); the glabrous upper leaf surface (upper surface hairy for *P. strigosa*); the hairs 0.4–0.5 mm long on the outer surface of the floral tube (hairs 0.6–0.9 mm long for *P. strigosa*); and the sepals 0.9–1.3 mm long (1.3–1.7 mm long for *P. strigosa*).

***Conservation status*:** Although this species is apparently not grazed by domestic stock, the known population is fewer than 100 plants, and there is a significant threat posed by

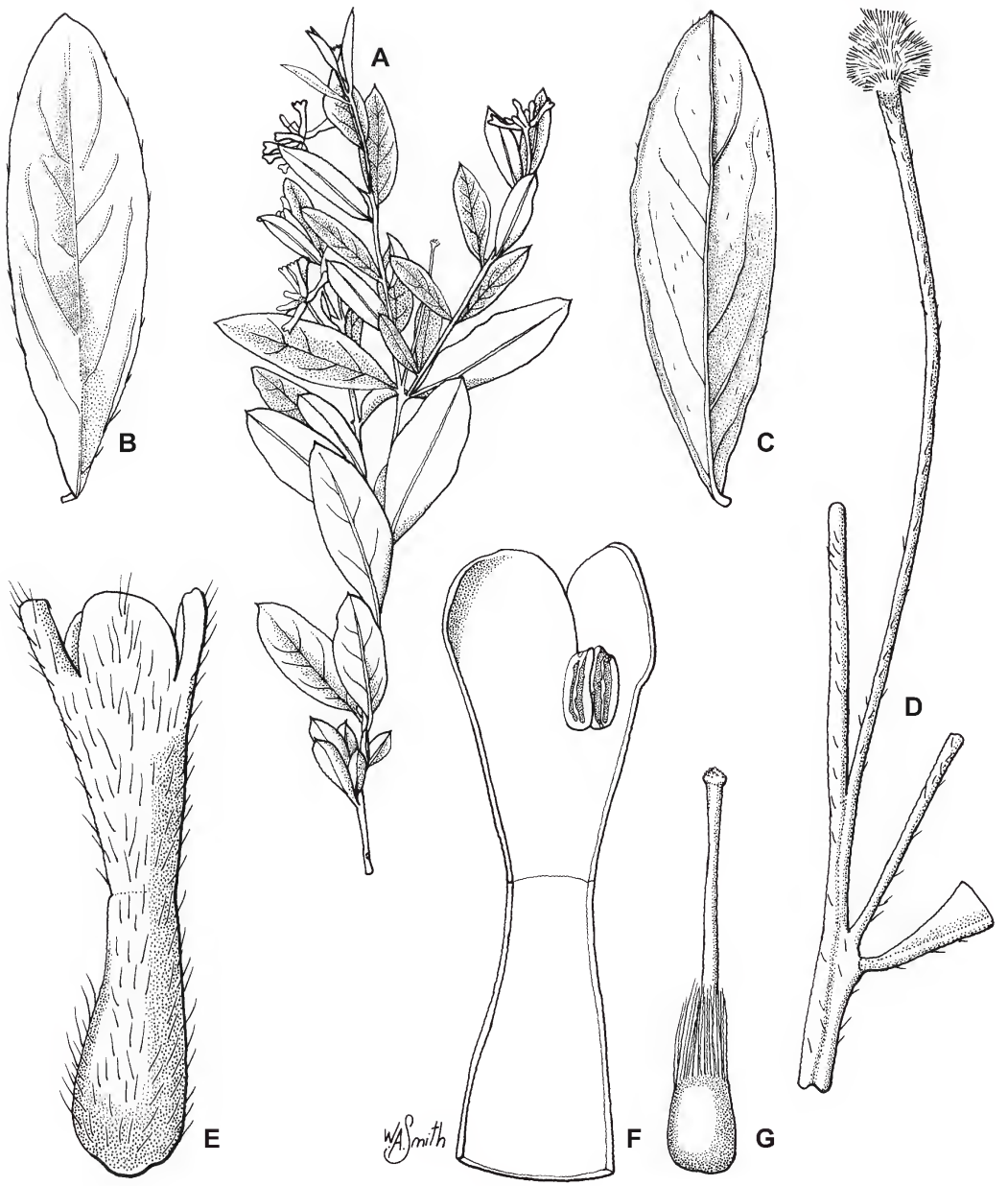

Fig. 5. ***Pimelea fugiens***. A. flowering branchlet ×1. B. upper leaf surface ×2. C. lower leaf surface ×2. D. old inflorescence, where all flowers and fruits have abscised, and peduncle ×4. E. floral tube and sepals ×12. F. half flower ×14. G. ovary and style ×14. A, E–G from *Bean 28739* (BRI); B–D from *Bean 10252* (BRI). Del. W. Smith.

alien invasive weeds, especially *Dolichandra unguis-cati* and *Lantana montevidensis*. Based on the IUCN Red List criteria (IUCN 2012), a conservation status of **Endangered** is recommended (B1ab(ii,iii,v)+2ab(ii,iii,v); D).

***Etymology*:** The epithet is from the Latin, and means 'avoiding, averse to'. This name is given because cattle avoid eating this plant, which is likely to be toxic. At the time the type was collected, this plant was thriving and untouched when many other nearby plant species had been heavily grazed by cattle.

10. Pimelea gigandra A.R.Bean **sp. nov.** with affinity to *P. altior*, but differing by the greater number of flowers per inflorescence, the longer floral tube and sepals, the hairs on the stems (away from the growing point) more or less appressed, the larger anthers, and the sparser tomentum on the upper leaf surface. **Typus:** Queensland. Moreton District: 0.3 km along Duck Creek road, Lamington National Park, 29 February 2016, *A.R. Bean 32730 & J. Wang* (holo: BRI; iso: BM, MEL, NSW, *distribuendi*).

Pimelea altior var. *longifolia* Domin, *Biblioth. Bot.* 89: 436 (1928). **Type:** Queensland. Moreton District: Tamborine Mountain, March 1910, *K. Domin s.n.* (holo: ?PR, *n.v.*).

Perennial shrub, 50–300 cm high, gynodioecious. Young stems densely hairy, longest hairs 0.6–1.3 mm long, appressed or antrorse, slender, transparent and somewhat shiny. Leaves opposite to sub-opposite, disjunction between leaf pairs 0–3 mm, internodes 15–36 mm long; petioles 1.8–3 mm long. Lamina elliptical, 33–82 mm long, 11–23 mm wide, 2.4–3.7 times longer than wide, midrib visible, lateral veins sometimes visible; apex obtuse or acute, mucronate; margins recurved. Upper surface of lamina very sparsely to sparsely hairy; hairs slender, longest ones 0.3–0.6 mm long, *c.* 0.025 mm wide, antrorse or patent. Lower surface of lamina sparsely to moderately densely hairy; hairs appressed to antrorse, slender, somewhat shiny, transparent, longest hairs 0.4–0.8 mm long, *c.* 0.025 mm wide. Inflorescence terminal, capitulate, with 10–19 flowers produced (= number of persistent pedicels), partly enclosed by four leafy bracts, two short and two rather longer. Rachis globose, at maturity 2–3.5 mm long, densely hairy; peduncle length 1–3 mm long. Some flowers female and some bisexual. Pedicels 0.5–0.8 mm long. Floral tube 8.5–11 mm long at anthesis, white; outer surface with hairs moderately dense to dense, patent near base and ± appressed near apex, longer ones 0.4–0.6 mm long; inner surface sparsely hairy. Sepals spreading, 3.1–4 mm long, apex acute, inner surface glabrous or sparsely hairy, outer surface sparsely to densely hairy. Staminal filaments 0.2–0.4 mm long; anthers 2–2.2 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 3.3–4.4 mm long, black, surface smooth. **Figs. 1E, 6, 7A.**

***Additional selected specimens examined*: Queensland.** Moreton District: Tamborine Heights Park, Contour Road, Mt Tamborine, Jan 2017, *Bean 32882* (BRI); Mt Tamborine, Mar 1937, *Blake 12883* (BRI); Nerang Creek, *s.dat.*, *Schneider s.n.* (BRI [AQ108783]); Track to Bushrangers Cave, Numinbah Gap, Mar 2007, *Nicholson NJN2859* (BRI); Springbrook, Macpherson Range, Sep 1930, *Hubbard 4265* (BRI); Caves Circuit, Lamington NP, Dec 1986, *Grimshaw s.n.* (BRI [AQ930686]); Araucaria Lookout, Lamington NP, Dec 2009, *Bean 29316* (BRI); Numinbah Forest Reserve, at northern end of Springbrook Plateau, Jul 2006, *Halford Q9119* (BRI); Macpherson Range (National Park), Jan 1919, *White s.n.* (BRI [AQ108777]); W slopes of Mt Tenduragan, near Numinbah, Oct 1938, *Blake 13854* (BRI, CANB, K); Near Ankida Nature Reserve, Springbrook, Sep 2005, *Thompson MOR596* (BRI). **New South Wales.** North Coast: Tweed River district, Mar 1896, *Betche s.n.* (NSW 121405); Brummies Lookout, SE of Tyalgum, Jul 1993, *Bean 6219* (BRI); Mt Nardi, NE of Nimbin, Sep 1972, *Rodd 2227* (NSW); Coopers Creek, via Mullumbimby, Aug 1936, *White 10461* (BRI, MO); Peates Mountain Road, Whian Whian SF, N of Lismore, Sep 1994, *Bean 7917* (BRI); Mt Warning, Oct 1898, *Forsyth s.n.* (NSW 127747); *ibid.*, Oct 1963, *Johnson 2740* (BRI); Richmond River, *s.dat.*, *Henderson s.n.* (MEL 50352); 2.9 km W of Rummery Road on Nightcap Road, in catchment of Rocky Creek Dam, Nightcap NP, Dec 2010, *Johnstone 2783 & Errington* (CANB, MEL, NSW); North Creek on the Richmond River, Aug 1884, *s. coll.* (MEL 57884); Richmond River, *s.dat.*, *Fawcett s.n.* (MEL 2181376); Mororo, NW of Iluka, Apr 2003, *Fensham 4876* (BRI).

***Distribution and habitat*:** *Pimelea gigandra* is confined to a relatively small area from Mt Tamborine, south-east Queensland to Mororo, north-east New South Wales (**Map 4**). It inhabits rainforest margins or tall open forest with *Eucalyptus grandis* W.Hill, *Corymbia intermedia* (R.T.Baker) K.D.Hill

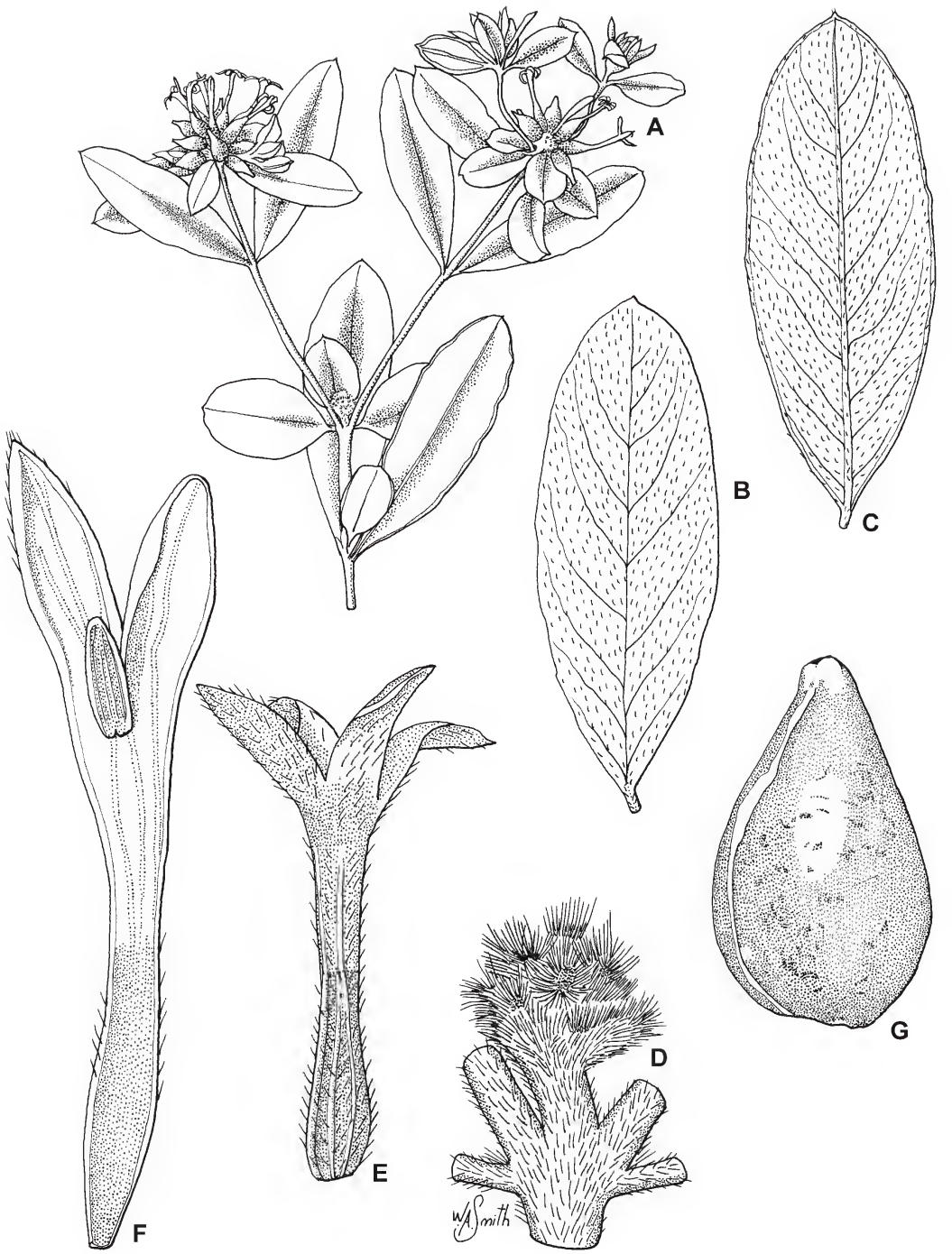

Fig. 6. ***Pimelea gigandra***. A. flowering branchlet ×1. B. upper leaf surface ×1.5. C. lower leaf surface ×1.5. D. old inflorescence, where all flowers and fruits have abscised, and peduncle ×6. E. floral tube and sepals ×6. F. half flower ×8. G. seed ×16. A–F from *Thompson MOR596* (BRI); G from *White s.n.* (BRI [AQ108777]). Del. W. Smith.

& L.A.S.Johnson, *Syncarpia glomulifera*, *E. pilularis* Sm. or *E. campanulata* R.T.Baker & H.G.Sm. It grows in shallow or deep basaltic soils.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Affinities*:** *Pimelea gigandra* differs from *P. altior* by the 10–19 flowers per inflorescence (4–7 flowers for *P. altior*), the floral tube 8.5–11 mm long and the sepals 3.1–4 mm long (floral tube 5.2–8.2 mm, sepals 0.9–1.6 mm for *P. altior*), the hairs on the stems (away from the growing point) more or less appressed, the anthers 2–2.2 mm long (0.8–1.2 mm long for *P. altior*), and the sparser tomentum on the upper leaf surface.

***Notes*:** *Pimelea gigandra* is unusual within *P.* section *Epallage* because of its long anthers (2–2.2 mm long), which exceed in length those of most other Queensland species in this section.

The type of *P. altior* var. *longifolia* has not been seen, but the description in the protologue confirms that it belongs in *P. gigandra*.

***Conservation status*:** While *Pimelea gigandra* is of relatively limited geographical range, it is a common species within that range. A conservation status of **Least Concern** is recommended (IUCN 2012).

***Etymology*:** From the Greek *gigas* meaning 'large or giant', and *andros* meaning 'man or male' (in botany, stamen or anther). The epithet refers to the size of the anthers in this species, which are much larger than those of *P. latifolia* and *P. altior*, with which it has been confused.

11. Pimelea latifolia R.Br., *Prodr.* 362 (1810); *Calyptrostegia latifolia* (R.Br.) Endl., *Gen. Pl. Suppl.* 4(2): 61 (1848); *Banksia latifolia* (R.Br.) Kuntze, *Rev. Gen. Pl.* 583 (1891); *Pimelea latifolia* subsp. *latifolia*, Threlfall in *Brunonia* 5: 192 (1983). **Type:** [Queensland]. Cumberland Islands, *s.dat.*, *R. Brown [Bennett No. 3189]* (lecto [here designated]: BM 000895089; isolecto: BM 000895090, K 000844976, K 000844977, MEL 57877, P 00710502, P 00713797).

Perennial shrub, 30–150 cm high, gynomonoecious. Young stems sparsely to densely hairy, longest hairs 0.6–1 mm long, slender, somewhat shiny and transparent, antrorse to spreading. Leaves alternate, internodes 2–19 mm long; petioles 1.2–2.2 mm long. Lamina obovate, 31–67 mm long, 13–24 mm wide, 1.7–3.6 times longer than wide, midrib visible, lateral veins sometimes visible; apex acute or obtuse, mucronate; margins flat. Upper surface of lamina glabrous or sparsely hairy; hairs slender, longest ones 0.4–0.6 mm long, *c.* 0.025 mm wide, appressed to antrorse. Lower surface of lamina sparsely to moderately densely hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 1–2 mm long, *c.* 0.02 mm wide. Inflorescence terminal, with 24–120 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis cylindrical, rarely ellipsoidal, at maturity 5–27 mm long, densely hairy; peduncle length 2–6 mm long. Flowers a mixture of bisexual and female. Pedicels 0.5–1 mm long. Floral tube 6.2–7.5 mm long at anthesis, white; outer surface with hairs sparse to moderately dense, antrorse, longer ones 0.2–0.5 mm long; inner surface glabrous. Sepals spreading, 1.6–2.3 mm long, apex obtuse, inner surface glabrous, outer surface densely hairy. Staminal filaments *c.* 0.05 mm long; anthers 0.9–1 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 4.6–4.8 mm long, black, surface ± smooth. **Fig. 7B.**

***Additional selected specimens examined*: Queensland.** North Kennedy District: Mt Elliot, *s.dat.*, *Fitzalan s.n.* (MEL 57885); western summit ridge of Mt Elliot, S of Townsville, Aug 1991, *Bean 3586* (BRI); Cape Cleveland section, Bowling Green Bay NP, S of Townsville, *Bean 3432* (BRI); Mt Mueller, Sep 1863, *Dallachy 21* (MEL); Proserpine River, in 1890, *Birch s.n.* (MEL 57887); Port Denison, *s.dat.*, *Fitzalan s.n.* (MEL 57883); Mid-reaches of Kelsey Creek, 8.5 km SSW of Proserpine, Aug 2007, *Fell DGF8447* (BRI); 2–4 km S of Mt Dryander, N of Proserpine, Apr 1985, *Rodd & Hardie 4447* (BRI, CANB, NSW); Mt Dryander, *s.dat.*, *Kilner & Fitzalan s.n.* (MEL 57888); Earlando Beach, 28 km N of Airlie Beach, site 90, Sep 1992, *Batianoff 9209248* (BRI); Cape Conway, Conway NP, May 1994, *Batianoff 940538 & Dillewaard* (BRI). South Kennedy District: North Road, Cathu SF, S of Proserpine, Nov 2010, *Bean 30597 et al.* (BRI, CANB, NSW); Bloomsbury via Mackay, Jun 1960, *Wilbraham s.n.* (BRI [AQ85902]); SF 658, Carawatha, Apr 1991, *Forster PIF8186 & McDonald* (BRI, MEL); Mt Blackwood NP, *c.* 30 km NNW of Mackay, May

Fig. 7. F. ***Pimelea gigandra.*** Cultivated plant with fruit at the Brisbane Botanic Gardens Mt Coot-tha (no voucher). Photo: H. Nicholson. G. ***P. gigandra.*** O'Reilly's Guest House, Lamington NP (no voucher). Photo: H. Nicholson. H. ***P. plurinervia.*** (*McDonald KRM17658 & Jensen*, BRI). Photo: R. Jensen. I. ***P. leptostachya*** (*Bean 29758*, BRI). Photo: A.R. Bean. J & K. ***P. rupestris*** (*Bean 28492*, BRI). Photo: A.R. Bean.

1991, *Bean 3154* (BRI); Palm Bay, St Bees Island, 36 km NE of Mackay, Mar 1989, *Batianoff 11113A* (AD, BRI); Scawfell Island NP, 50 km ENE of Mackay, Nov 1986, *Batianoff 6081* (AD, BRI, NSW); Connors River, Sarina, Jun 1955, *Beauglehole ACB3543* (MEL); Prudhoe Island NP, 53 km SE of Mackay, Nov 1992, *Batianoff 921110* (AD, BRI). LEICHHARDT DISTRICT: Wandoo, Jul 1959, *Gittins 267* (BRI, CANB); Pine Mountain, SF 79, Apr 1991, *Forster PIF8010 & McDonald* (BRI, MEL). PORT CURTIS DISTRICT: Ogmore, Sep 1943, *Blake 15310* (BRI, MEL); Rockhampton, *s.dat.*, *O'Shanesy 61* (MEL); Struck Oil, Feb 1986, *Hoy 118* (BRI); Head of the Dee [River], Jan 1867, *Bowman 47* (MEL).

***Distribution and habitat*:** *Pimelea latifolia* is endemic to eastern Queensland with a distribution extending from Townsville to just south of Rockhampton, including continental islands (**Map 1**). It grows on margins of rainforest or vinethicket, on shallow soils at altitudes below 400 metres. On the islands of the Whitsunday group, it is found on coastal headlands adjacent to littoral rainforest.

***Phenology*:** Flowers and fruits have been recorded for every month of the year except December.

***Notes*:** The name *Pimelea latifolia* has been widely misapplied to other species, mainly *P. altior*.

Plants from the islands tend to have obtuse and mucronate leaf apices, while those from mainland areas usually have acute and mucronate leaf apices.

***Conservation status*:** *Pimelea latifolia* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

12. Pimelea leptospermoides F.Muell., *Fragm.* 7: 2 (1869); *Banksia leptospermoides* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 583 (1891). **Type:** Queensland. PORT CURTIS DISTRICT: Cawarral, *s.dat.*, *A. Thozet s.n.* (lecto [here designated]: K 000844992; isolecto: K 000844991, MEL 57889, MEL 57890).

Perennial shrub, 30–100 cm high, gynodioecious. Young stems densely hairy, longest hairs 0.25–0.9 mm long, thick, white and opaque or shiny and transparent, appressed, antrorse or spreading. Leaves alternate, internodes 0.5–10 mm long; petioles 0.7–1 mm long. Lamina elliptic, obovate or oblanceolate, 8.5–26 mm long, 2.6–7 mm wide, 2.2–5.3 times longer than wide, midrib visible, lateral veins sometimes faintly visible; apex acuminate to mucronate; margins flat. Upper surface of lamina glabrous or with hairs very sparse to dense, hairs appressed, slender, 0.2–0.7 mm long. Lower surface of lamina hairy; hairs appressed, antrorse or patent, slender, somewhat shiny, white or transparent, longest hairs 0.25–0.9 mm long, *c.* 0.025 mm wide, dense or sparse. Inflorescence terminal or axillary, capitulate, with 3–7 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis globular, at maturity 1–2 mm long, densely hairy; peduncle obsolete. Bisexual flowers and female flowers on separate plants. Pedicels 0.3–0.5 mm long. Floral tube 4.8–8.2 mm long at anthesis, white; outer surface with hairs dense, appressed (antrorse), longer ones 0.2–0.6 mm long; inner surface hairy. Sepals

Two subspecies are recognised, distinguished by the following key:

Hairs on lower leaf surface antrorse to patent, dense, 0.8–0.9 mm long; hairs on floral tube 0.4–0.6 mm long . . . . . **12a. P. leptospermoides** subsp. **bowmanii**

Hairs on lower leaf surface appressed, sparse, 0.25–0.6 mm long; hairs on floral tube 0.2–0.3 mm long . . . . . **12b. P. leptospermoides** subsp. **leptospermoides**

widely spreading, 1.6–2.5 mm long, apex acute, inner surface glabrous, outer surface densely hairy. Staminal filaments *c.* 0.05 mm long; anthers 1.8–2.2 mm long, dehiscence introrse. Style not or scarcely exserted. Seeds 2.6–3.2 mm long, black, surface smooth or with faint lines.

12a. Pimelea leptospermoides subsp. **bowmanii** (Benth.) A.R.Bean **comb. et stat. nov.**; *Pimelea bowmanii* Benth., *Fl. Austral.* 6: 30 (1873), as 'bowmanni'. **Type:** Queensland. PORT CURTIS DISTRICT: Broadsound, *s.dat.*, *E.M. Bowman s.n.* (lecto [here designated]: K 000900014; isolecto: MEL 50537).

Young stems with longest hairs 0.8–0.9 mm long, antrorse to spreading. Lamina 8.5–18 mm long, 4–6 mm wide, 2.2–3.8 times longer than wide. Upper surface of lamina with hairs moderately dense to dense, hairs 0.5–0.7 mm long. Lower surface of lamina with hairs antrorse to patent, slender, longest hairs 0.8–0.9 mm long. Floral tube outer surface with hairs dense, longer ones *c.* 0.5 mm long.

***Additional specimens examined*: Queensland**. Port Curtis District: S of Atkinson Road, 1.8 km across open field near pylon line, *c.* 40 km SE of Marlborough, Apr 2008, *Reeves 3431 & Batianoff* (BRI, E, HO, MEL); Atkinson Road, *c.* 30 km W of Bruce Highway, W of Glen Geddes, Apr 2008, *Reeves 3450 & Batianoff* (BRI, E); S of Atkinson Road, 0.8 km across open field near pylon line, *c.* 30 km SE of Marlborough, Apr 2008, *Reeves 3427 & Batianoff* (BRI, E, MEL); Atkinsons Road, Canoona, 25 km from Bruce Hwy, Mar 1994, *Bean 7527 & Forster* (BRI); Broadsound, *s.dat.*, *Bowman 50* (BRI, MEL).

***Distribution and habitat*:** *Pimelea leptospermoides* subsp. *bowmanii* is endemic to Queensland and is apparently confined to the Atkinson Road area west of Canoona, about 65 km north-west of Rockhampton (**Map 7**). It is restricted to shallow soils derived from serpentinite rocks, and occurs as an understorey plant in shrubby eucalypt woodland.

***Phenology*:** Flowers and fruits have been recorded in March and April.

***Affinities*:** *Pimelea leptospermoides* subsp. *bowmanii* differs from the typical subspecies by the indumentum pattern. The hairs are longer on all plant parts, antrorse to spreading on the stems and leaves (usually appressed in subsp. *leptospermoides*), and moderately dense to dense on the upper leaf surface (very sparse, sparse or glabrous for subsp. *leptospermoides*).

***Conservation status*:** *Pimelea leptospermoides* subsp. *bowmanii* is known from three subpopulations with an estimated area of occupancy of less than 1 km^2. The subpopulations are threatened by road widening, land clearing and grazing. Applying the Red List criteria (IUCN 2012), a conservation status of **Endangered** is recommended (B1ab(ii,iii)+2ab(ii,iii)).

12b. Pimelea leptospermoides subsp. leptospermoides

***Illustration*:** Melzer & Plumb (2007: 345).

Young stems with longest hairs 0.25–0.5 mm long, appressed to antrorse. Lamina 8–26 mm long, 2.6–7 mm wide, 2.2–5.3 times longer than wide. Upper surface of lamina glabrous, or very sparsely to sparsely hairy, hairs 0.2–0.4 mm long. Lower surface of lamina with hairs appressed, longest hairs 0.25–0.6 mm long. Floral tube hairs dense, appressed, longer ones 0.2–0.3 mm long.

***Additional selected specimens examined*: Queensland.** Port Curtis District: Marlborough, Oct 1937, *White 12114* (BRI); 8.5 km W of Marlborough, along Old Bruce Highway, Jun 2009, *Bean 28991* (BRI, CANB); 1 mile [1.7 km] N of Marlborough homestead, Jun 1963, *Lazarides 6879* (BRI, CANB); *c.* 12 km N of Marlborough on inland road to Sarina, Jun 1997, *Plumb JP45* (BRI); Mt Slopeaway, near Marlborough, Aug 1963, *Specht 1748* (BRI); Lot 11, Princhester Parish, about 10km SE of Marlborough, Jun 1995, *Sinclair GS95033* (BRI); Marlborough Creek, 25 km SW of Marlborough, Magpie mining lease, Nov 1997, *McCabe & Rayner 38* (BRI); Balmoral, vegetation monitoring site, *c.* 6 km N of Glen Geddes, Jun 1983, *Anderson 3402* (BRI); Marlborough Creek near Frasers Working Mine, 13 km south of Marlborough Station, May 1991, *Batianoff MC9105002 & Franks* (AD, BRI, CANB, CNS, MEL, NSW); Eden Bann, SE of Marlborough, May 1993, *Batianoff & Guymer s.n.* (AD, BRI [AQ796134], CANB, MEL, MO, NSW, NY); Site 11, Ramilles block, Marlborough, Dec 1998, *Batianoff 9812186 et al.* (BRI, CANB, MEL, NSW); Glen Geddes, 2–3 km from Bruce Highway, Apr 2008, *Reeves 3469 & Batianoff* (BRI, DNA, E, NSW); Glen Geddes, 8.3 km from Coorumburra SF turnoff, Oct 1991, *Batianoff 911010 & Robins* (AD, BRI, CANB, DNA, K, L, MEL, NSW); 1 km W of Glen Geddes Rail siding, May 1992, *Forster PIF9899* (BRI, CANB, K, MEL, NSW); Just west of Canoona, *c.* 45 km NW of Rockhampton, on the road to Mona Vale, Nov 1990, *Henderson H3493 & Robins* (BRI, MEL); Mt Wheeler, 12 km SW of Yeppoon, Oct 1991, *Batianoff 911022* (AD, BRI, DNA, MEL, NSW); Base of Mt Wheeler, 15 km E of Rockhampton, Aug 1981, *Shanahan 3* (BRI).

***Distribution and habitat*:** *Pimelea leptospermoides* subsp. *leptospermoides* is endemic to sub-coastal central Queensland, between Canoona and Marlborough (**Map 7**). It is restricted to shallow soils derived from serpentinite rocks, and occurs as an understorey plant in shrubby eucalypt woodland.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Typification*:** When citing the type of *Pimelea leptospermoides*, Threlfall (1983) stated "*Lectotypus:* Cawarra, *Thozet,* Herb. F. Mueller (K)." However, there are two sheets at Kew with these details. A second-stage lectotypification is made here.

***Conservation status*:** *Pimelea leptospermoides* subsp. *leptospermoides* is known from about 22 subpopulations with an estimated area of occupancy of 30 km^2. Most subpopulations are not threatened by land clearing or grazing. However, there is a significant threat from mining, as valuable minerals are extracted from the serpentinite rock upon which the subspecies grows. It is considered that this subspecies does not meet the Red List criteria for Vulnerable (IUCN 2012), but it may do in the near future, and a conservation status of **Near Threatened** is recommended.

13. Pimelea leptostachya Benth., *Fl. Austral.* 6: 24 (1873). **Type:** Queensland. Port Curtis District: Herbert's Creek, near Rockhampton, in 1871, *E.M. Bowman s.n.* (lecto [here designated]: MEL 57894; isolecto: K 000844980, MEL 57891, MEL 57893, MEL 58299).

Perennial shrub, 20–40 cm high, gynomonoecious. Young stems densely hairy, longest hairs 0.7–1 mm long, coarse, shiny and transparent, appressed. Leaves alternate (except at base of plant), internodes 1–16 mm long; petioles 0.7–1.1 mm long. Lamina narrowly-elliptic, 11–30 mm long, 3–5.5 mm wide, 3.7–6 times longer than wide, with only midrib visible, apex acute, margins flat. Upper surface of lamina glabrous. Lower surface of lamina hairy; hairs appressed, coarse, shining, transparent, longest hairs 0.6–1.2 mm long, *c.* 0.05 mm wide, very sparse. Inflorescence terminal, spicate, with 13–23 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis linear, at maturity 25–45(–80) mm long, sparsely hairy; peduncle length 2–11 mm long. Flowers bisexual or female. Pedicels 2–3 per cm of rachis, each 0.9–2 mm long. Floral tube 3.9–5 mm long at anthesis, maroon or yellow; outer surface with hairs sparse, antrorse, 0.4–0.6 mm long; inner surface glabrous. Sepals erect, 0.8–1.2 mm long, apex obtuse, inner surface glabrous, outer surface sparsely hairy. Staminal filaments *c.* 0.05 mm long; anthers 0.8–0.9 mm long, dehiscence introrse. Style not or scarcely exserted. Fruit orientation ascending. Seed ovoid, 3.6–3.7 mm long, black, surface colliculate. **Fig. 7C.**

***Additional specimens examined*:** **Queensland**. Leichhardt District: Bundoora SF, *c.* 40 km NE of Capella, May 2009, *Bean 28760* (BM, BRI, NSW, NY); Bundoora SF, *c.* 40 km NE of Capella, May 2009, *Bean 28758* (B, BRI, MEL, PRE); Bundoora SF, *c.* 40 km NE of Capella, May 2009, *Bean 28768* (BRI); Dalmally Road, S of Springsure, Oct 1998, *Bean 14056* (BRI, MEL); Injune – Rolleston Road, 86 km N of Injune, Mar 1994, *Hohnen 51* (BRI); Injune – Rolleston Road, 86 km N of Injune, Mar 1994, *Halford Q2162* (BRI, L, MEL); 56 km NW of Injune, Jun 2011, *Paterson s.n.* (BRI [AQ796629]); 4–5 km NE of Injune, Dec 2011, *Schell s.n.* (BRI [AQ798495]); Injune – Taroom Road, *c.* 54 km E of Injune, Apr 2010, *Eddie CPE1932* (BRI).

***Distribution and habitat*:** *Pimelea leptostachya* is endemic to Queensland, from Capella in the north to Injune in the south, and from Springsure to Rockhampton (**Map 6**). It inhabits sandy soils on hillsides, often adjacent to sandstone cliffs or outcrops.

***Phenology*:** Flowers and fruits are recorded from March to June and from October to December.

***Typification*:** Bentham cited specimens from Rockhampton (now at K) and Herbert's Creek (now at MEL), so he evidently saw all of Bowman's collections of it. I believe that all of Bowman's collections were from Herbert's Creek and that Mueller truncated the locality when writing the label of the specimen now at K. This latter specimen has roots and is a very good match for the lectotype and similarly is a plant that has been pulled up by the roots.

The year written by Mueller on the label of the lectotype appears to read '1878', but Bowman died in 1872. One of the isolectotypes has the year '1871' on its label. This is probably correct, as Bowman made many other collections from Herbert's Creek in 1871.

***Affinities*:** *Pimelea leptostachya* is closely allied to *P. sericostachya*, but the former differs by the 13–23 flowers per inflorescence (33–95 flowers for *P. sericostachya*); the

anthers 0.8–0.9 mm long (1.1–1.3 mm long for *P. sericostachya*); the sepals 0.8–1.2 mm long (1.5–2.1 mm long for *P. sericostachya*); and the hairs on the outside of the floral tube 0.4–0.6 mm long (1–1.4 mm long for *P. sericostachya*).

***Notes*:** A specimen from near Springsure (*Bean 14056*) has longer rachises (60–80 mm) than all other collections of *P. leptostachya*, but otherwise appears to conform to it.

***Conservation status*:** *Pimelea leptostachya* is known from six subpopulations with an estimated area of occupancy of 5 km^2. Most subpopulations are either in conservation reserves or are remote from disturbances such as roads or grazing, and there are no current perceived threats. Therefore a conservation status of **Least Concern** is recommended.

14. Pimelea mollis A.R.Bean **sp. nov.** with affinity to *P. latifolia*, but differing by the longer hairs on the stems and the floral tube, the very dense hairs on the floral tube, the consistently hairy upper leaf surface, the shorter sepals and the shorter seeds. **Typus:** Queensland. Port Curtis District: Callide Range, NNE of Biloela, 10 May 2009, *A.R. Bean 28756* (holo: BRI; iso: CANB, MEL, NSW).

Perennial shrub, 50–100 cm high, gynomonoecious. Young stems sparsely to densely hairy, longest hairs 1.8–2.6 mm long, slender, somewhat shiny and transparent, antrorse to spreading. Leaves opposite to sub-opposite, disjunction between leaf pairs 0–5(–7) mm, internodes 10–27 mm long; petioles 1.5–2.2 mm long. Lamina elliptic, 32–49 mm long, 11–17 mm wide, 2.4–3.5 times longer than wide, midrib visible, a few lateral veins sometimes visible; apex acute, obtuse or mucronate; margins flat. Upper surface of lamina consistently hairy; hairs slender, longest ones 1.1–1.7 mm long, *c.* 0.025 mm wide, antrorse; sparse. Lower surface of lamina hairy; hairs appressed to antrorse, slender, somewhat shiny, transparent, longest hairs 1.1–1.7 mm long, *c.* 0.025 mm wide, sparse to moderately dense. Inflorescence axillary, capitulate, with 24–45 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis ellipsoidal, at maturity 4–11 mm long, very densely hairy; peduncle length 4–16 mm long. Flowers a mixture of bisexual and female. Pedicels 0.7–1.1 mm long. Floral tube 5.5–7.2 mm long at anthesis, white; outer surface with dense, antrorse to patent hairs, longer ones 0.7–1.9 mm long; inner surface glabrous. Sepals at 45° or spreading, 1.3–1.7 mm long, apex obtuse, inner surface glabrous, outer surface densely hairy. Staminal filaments 0–0.1 mm long; anthers 1–1.25 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 3.4–3.7 mm long, black, surface ± smooth. **Fig. 8.**

***Additional specimens examined*: Queensland**. Leichhardt District: Rockland Spring, *c.* 22 miles [35 km] S of Bluff, Aug 1964, *Gittins 907* (BRI, CANB, NSW); Nugga Nugga Holding, 65 km SW of Bauhinia, Aug 2010, *Eddie CPE1606 & Harris* (BRI); Sunnyholt Holding, Arcadia Valley, *c.* 70 km NNE of Injune, Oct 2008, *Eddie CPE2124* (BRI); Lonesome Holding, at southern end of the Battleship just below summit, NE of Injune, Apr 2004, *Eddie Lot6 et al.* (BRI); Lonesome Holding, *c.* 51 km NE of Injune, Oct 2011, *Eddie CPE1997* (BRI); Kentucky, *c.* 45 km NE of Injune, May 2010, *Eddie CPE1587 & Harris* (BRI); 25.1 km ENE of Taroom, eastern slopes of Mt Glebe, Beaumont Station, Nov 1996, *Halford Q3107 & Dowling* (AD, BRI). Port Curtis District: TR170, Callide Range, NNE of Biloela, Apr 2003, *Bean 20201* (BRI, MEL); Greycliffe, Biloela, Sep 1992, *Noble s.n.* (BRI [AQ517498]); Davis Road, Biloela, Oct 1992, *Noble 2* (BRI); Blackman's Creek, 19 km SW of Miriam Vale, Dec 1990, *Brushe TOI203* (BRI). Burnett District: Fontainea Scrub, SF172, Gurgeena Plateau, Mar 1994, *Forster PIF15062* (BRI, CNS, MEL); Mondure SF, S of Hivesville, Apr 2015, *Forster PIF42239 & Thomas* (BRI); Meandu mine, near Nanango, site SW6BT1, Oct 2015, *Neldner 5715* (BRI); Tarong mine site, 18 km SW of Nanango, Jan 1997, *Bellairs 128* (BRI).

***Distribution and habitat*:** *Pimelea mollis* is endemic to southern Queensland, mainly away from the coast, as far south as Injune and Nanango, and north to Biloela and Dingo (**Map 5**). It most often inhabits semi-evergreen vinethicket and adjacent open eucalypt forest on plateaux with red lateritised basalt, but sometimes occurs in forest dominated by *Acacia rhodoxylon* Maiden.

***Phenology*:** Flowers and fruits have been recorded in March-April and also August-November.

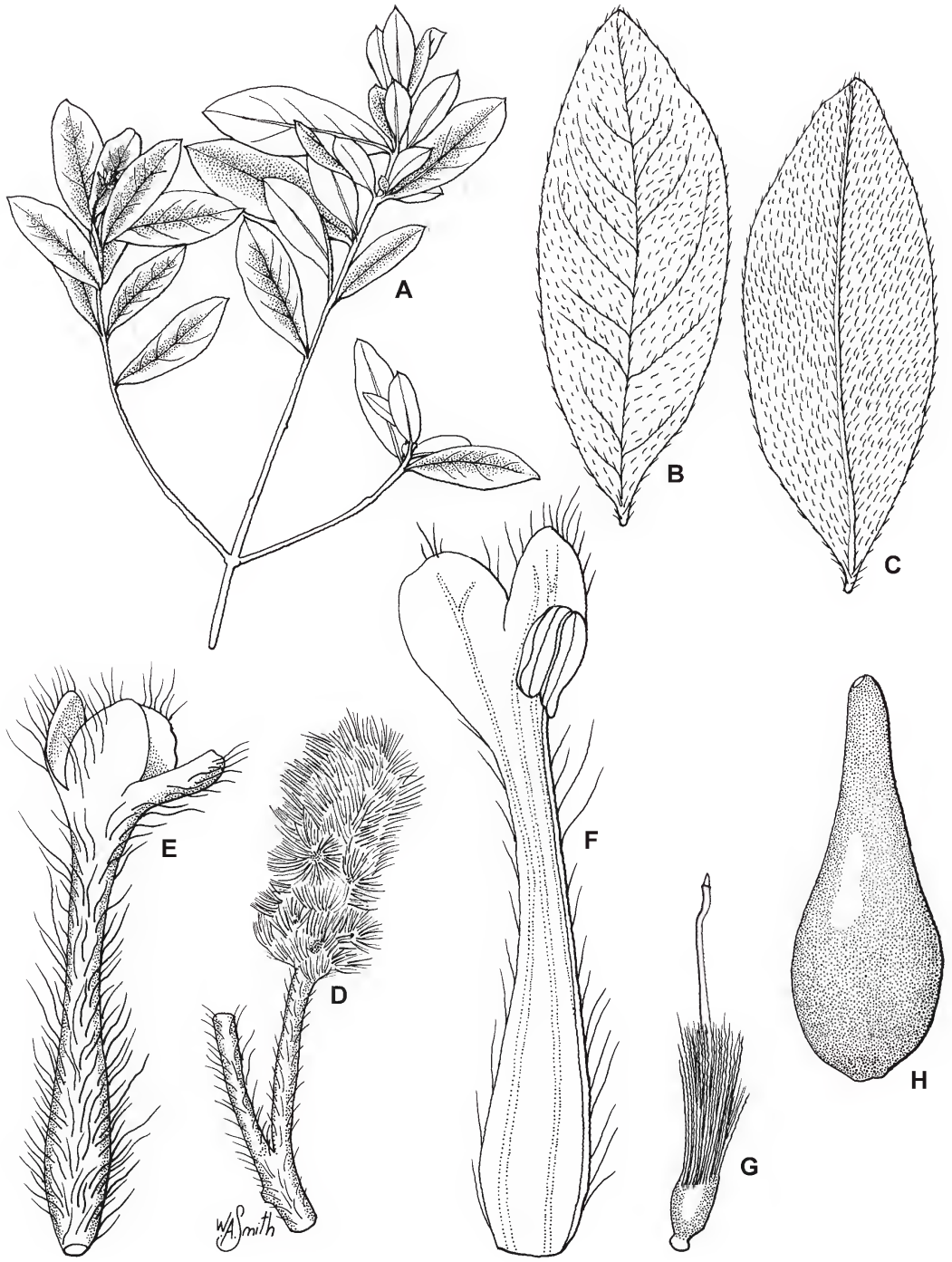

Fig. 8. ***Pimelea mollis***. A. flowering branchlet ×0.6. B. upper leaf surface ×2. C. lower leaf surface ×2. D. old inflorescence, where all flowers and fruits have abscised, and peduncle ×4. E. floral tube and sepals ×10. F. half flower ×12. G. ovary and style ×12. H. seed ×16. A–C from *Eddie CPE1606 & Harris* (BRI); D from *Noble s.n.* (BRI [AQ517498]); E–H from *Forster PIF42239 & Thomas* (BRI). Del. W. Smith.

***Affinities*:** *Pimelea mollis* is allied to *P. latifolia*, but differs by the longest stem hairs 1.8–2.6 mm long (0.6–1 mm long in *P. latifolia*), the elliptical leaves (obovate in *P. latifolia*); the consistently hairy upper leaf surface with hairs 1.1–1.7 mm long (upper surface often glabrous, hairs when present 0.4–0.6 mm long for *P. latifolia*); the peduncles (4–)6–16 mm long (2–6 mm long for *P. latifolia*); the very dense hairs 0.7–1.9 mm long on the outer surface of the floral tube (sparse to moderately dense hairs 0.2–0.5 mm long for *P. latifolia*); the sepals 1.3–1.7 mm long (1.6–2.3 mm long for *P. latifolia*), and the seeds 3.4–3.7 mm long (4.6–4.8 mm long for *P. latifolia*).

Pimelea mollis can also be confused with *P. strigosa*, but *P. mollis* differs by the leaves 11–17 mm wide (4.8–9.5 mm wide for *P. strigosa*), the hairs on the upper leaf surface 1.1–1.7 mm long (0.3–0.7 mm long for *P. strigosa*), the rachis 4–11 mm long (2–3 mm for *P. strigosa*), the 24–45 flowers per inflorescence (18–23 for *P. strigosa*), and the anthers 1–1.25 mm long (0.7–0.8 mm long for *P. strigosa*).

***Conservation status*:** *Pimelea mollis* is known from 13 subpopulations with an estimated area of occupancy of 5 km^2. There is some threat from road widening, vegetation clearing or weed encroachment, particularly *Lantana camara* L. It is considered that this species does not meet the Red List criteria for Vulnerable (IUCN 2012), but it may do in the near future, and a conservation status of **Near Threatened** is recommended.

***Etymology*:** The epithet is from the Latin *mollis* meaning soft. This is given for the soft hairs present on the stems and leaves.

15. Pimelea plurinervia A.R.Bean **sp. nov.** with affinity to *P. latifolia*, but differing by the numerous conspicuous lateral veins of the leaves, the shorter rachis and peduncles, the fewer flowers, and the hairy inner surface of the floral tube. **Typus:** Queensland. North Kennedy District: Bishops Peak, Hinchinbrook Channel National Park, N of Ingham, 31 May 1991, *A.R. Bean 3252* (holo: BRI; iso: CANB, *distribuendi*).

Perennial shrub, 50–200 cm high, gynomonoecious. Young stems densely hairy, longest hairs 0.6–1.2 mm long, slender, white and opaque or somewhat shiny and transparent, appressed, antrorse or spreading. Leaves alternate, internodes 2–13 mm long; petioles 1.5–2.8 mm long. Lamina oblanceolate, obovate or elliptic, 21–58 mm long, 6.5–14 mm wide, 2.4–5.1 times longer than wide, midrib and 10–14 pairs of lateral veins readily visible below; apex obtuse or acute, mucronate; margins recurved. Upper surface of lamina glabrous or hairy; hairs slender, longest ones 0.3–0.6 mm long, *c.* 0.025 mm wide, appressed, antrorse or patent; very sparse to sparse. Lower surface of lamina hairy; hairs appressed or antrorse, slender, somewhat shiny, transparent, longest hairs 0.35–1 mm long, *c.* 0.025 mm wide, sparse. Inflorescence terminal, capitulate, with 8–18 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis ellipsoidal or globular, at maturity 2–4 mm long, very densely hairy; peduncle length 0–1.5 mm long. Some flowers bisexual, some female. Pedicels 0.8–1.3 mm long. Floral tube 4.5–8.8 mm long at anthesis, white; outer surface with hairs moderately dense, antrorse to appressed, longer ones 0.35–0.6 mm long; inner surface sparsely hairy. Sepals widely spreading, 1.6–3.7 mm long, apex acute or obtuse, inner surface glabrous, outer surface sparsely hairy. Staminal filaments *c.* 0.05 mm long; anthers 1.8–2.8 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 3–4.1 mm long, black, surface foveolate or smooth. **Figs. 7D, 9.**

***Additional specimens examined*: Queensland.** North Kennedy District: Tully Falls Weir, Jun 1995, *Forster PIF16754* (BRI, MEL); Koombooloomba Weir Road, E of Tully Falls Road, S of Ravenshoe, Jan 2016, *McDonald KRM17658 & Jensen* (BRI); Tully Falls, Feb 1996, *Gray 6609* (BRI, CNS); NP 279, Tully Gorge, Dec 1995, *Gray 6475* (BRI, CNS); SFR756, Park LA, Tully Weir Road, Aug 1998, *Ford 2093* (BRI, CNS); 32 km S of Cardwell, Bishops Peak, Nov 1991, *Halford Q705* (BRI); Headland S of Sunken Reef Bay, Hinchinbrook Island, Sep 1994, *Cumming 13363* (BRI); 24 km S of Cardwell, *c.* 80 m W of Bruce Hwy at Waterfall Creek, May 1976, *Thorsborne & Thorsborne 213* (BRI); Hinchinbrook Island, *c.* 2.5 km NW of Mt Diamantina, Dec 2000, *Anderson TH2598* (BRI); NE slopes of Mt Diamantina, Hinchinbrook Island, Aug 1951, *Blake 18866* (BRI); Cardwell Range, E slopes of Bishop Peak, *c.* 0.5 km E of summit, Aug 1996,

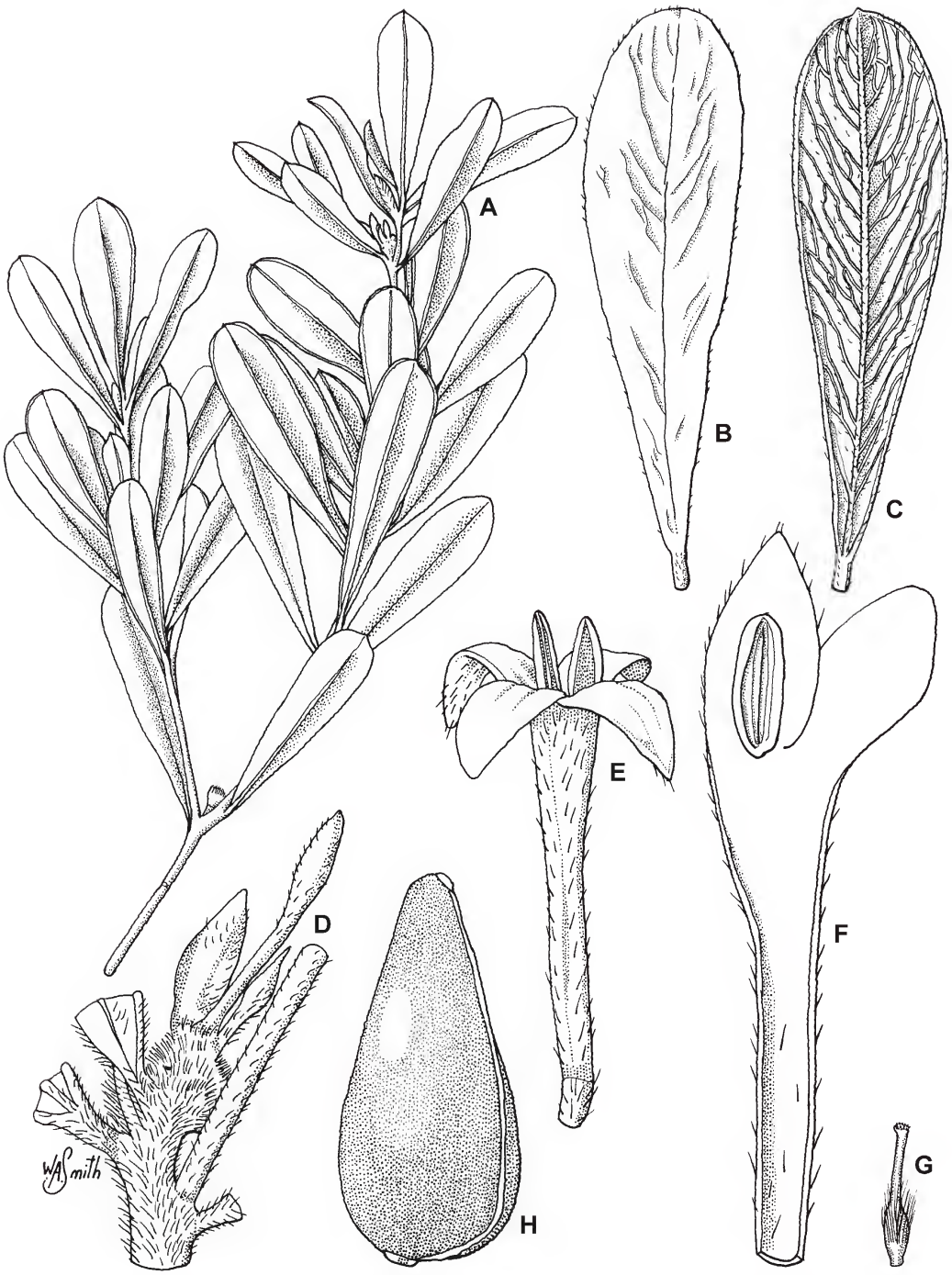

Fig. 9. ***Pimelea plurinervia***. A. flowering branchlet ×1. B. upper leaf surface ×2. C. lower leaf surface ×2. D. old inflorescence, where most flowers and fruits have abscised, and peduncle ×4. E. floral tube and sepals ×6. F. half flower ×8. G. ovary and style ×8. H. seed ×16. A–C from *Anderson TH2598* (BRI); D–H from *Forster PIF16754* (BRI). Del. W. Smith.

Telford 12157 & Donaldson (BRI, CANB); Hinchinbrook Island, ridge 1 km N of Mt Bowen, Aug 1975, *Hockings s.n.* (BRI [AQ250232]); Hinchinbrook Island, *c.* 2 km WSW of Mt Bowen, Dec 2000, *Kemp TH2906* (BRI); Hinchinbrook Island, upper south Zoe Creek, Sep 1994, *Hohnen s.n.* (BRI [AQ650755]); Cardwell Range, Apr 1947, *Flecker 10908* (NSW).

***Distribution and habitat*:** *Pimelea plurinervia* is endemic to north-east Queensland where it is known from Hinchinbrook Island, Bishop's Peak (mainland opposite Hinchinbrook Island), and in the Tully Falls area south of Ravenshoe (**Map 3**). It inhabits wet sclerophyll forest with rainforest elements, rainforest margins, and rocky mountains with *Allocasuarina littoralis* (Salisb.) L.A.S.Johnson, *Banksia plagiocarpa* A.S.George or *Kunzea graniticola* Byrnes. In all cases, the geology is granite, and the soil is shallow or skeletal.

***Phenology*:** Flowers and fruits are recorded from August to February, and also in May and June.

***Affinities*:** *Pimelea plurinervia* is allied to *P. latifolia*, but differs by the leaves having numerous conspicuous lateral veins (lateral veins either not visible, or a few faintly visible for *P. latifolia*), the rachises 2–4 mm long (5–27 mm long for *P. latifolia*), the 8–18 flowers per inflorescence (24–120 flowers for *P. latifolia*), the peduncles 0–1.5 mm long (2–6 mm long for *P. latifolia*), and the inner surface of the floral tube sparsely hairy (glabrous for *P. latifolia*).

***Note*:** Female flowers in this species have shorter floral tubes and sepals than the bisexual flowers occurring in the same inflorescence.

***Conservation status*:** *Pimelea plurinervia* is known from six subpopulations with an estimated area of occupancy of 15 km^2. Most subpopulations are within conservation reserves, and no specific threats have been identified. Therefore a conservation status of **Least Concern** is recommended.

***Etymology*:** From the Latin *pluri* meaning 'many' and *nervis* meaning 'nerves' or 'veins'. This refers to the leaves of this species having numerous conspicuous lateral veins.

16. Pimelea rupestris A.R.Bean **sp. nov.**, distinguished by its dioecious habit, the persistent floral tube that is conspicuously hairy on the inner surface, the ellipsoid rachis and very short peduncles. **Typus:** Queensland. Wide Bay District: Western slope of Widgee Mountain, *c.* 30 km W of Gympie, 7 February 2009, *A.R. Bean 28492* (holo: BRI; iso: CANB, MEL, NSW, *distribuendi*).

Perennial shrub, 50–100 cm high, dioecious. Young stems moderately to very densely hairy, longest hairs 0.2–0.3 mm long (Qld) or 0.6–0.7 mm long (NSW), slender, white and opaque, appressed. Leaves alternate, internodes 2–6(–9) mm long; petioles 1.3–2.3 mm long. Lamina obovate to elliptical, 10–29 mm long, 4.5–9 mm wide, 2.2–4 times longer than wide, midrib visible, lateral veins usually visible; apex acute or obtuse, mucronate; margins recurved. Upper surface of lamina usually glabrous but sometimes hairs present along midrib; hairs slender, longest ones 0.15–0.25 mm long, *c.* 0.025 mm wide, appressed. Lower surface of lamina sparsely hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 0.2–0.3 mm long, *c.* 0.025 mm wide. Inflorescence axillary, capitulate, with 40–80 flowers produced (= number of persistent pedicels). Rachis ellipsoidal, at maturity 2–4 mm long, densely hairy; peduncle length 0–1.5 mm long. Flowers either all female or all male on any given plant. Pedicels 0.2–0.3 mm long. Floral tube 3–4.4 mm long at anthesis, white, persistent, not circumscissile; outer surface with hairs dense to very dense, appressed, longer ones 0.25–0.3 mm long (Qld) or *c.* 0.5 mm long (NSW); inner surface conspicuously hairy. Sepals erect to spreading, 1.5–2.2 mm long, apex acute, inner surface sparsely hairy, outer surface densely hairy. Staminal filaments 0.2–0.5 mm long; anthers 1–1.2 mm long, dehiscence introrse. Style exserted in female flowers, *c.* 3.5 mm long. Seed ovoid, 2.5–2.7 mm long, black, surface smooth. **Figs. 7E–F, 10.**

***Additional specimens examined*: Queensland**. Wide Bay District: Western slope of Widgee Mt, *c.* 30 km W of Gympie, Feb 2009, *Bean 28488* (BRI); *ibid.*, Feb 2009, *Bean 28489* (BRI, CANB, NSW); Mt Widgee, Mar 2000, *Forster PIF25317 & Booth* (AD, BRI, MEL,

Fig. 10. ***Pimelea rupestris***. A. flowering branchlet ×2. B. upper leaf surface ×4. C. lower leaf surface ×4. D. old inflorescence, where all flowers and fruits have abscised ×6. E. floral tube and sepals ×12. F. half flower ×14. G. seed ×24. A–F from *Bean 28489* (BRI); G from *Bean 17340* (BRI). Del. W. Smith.

NSW); Mt Widgee, summit area, south-western slopes, Sep 1996, *Leiper s.n.* (BRI [AQ650112]). **New South Wales.** North Coast: 4.3 km along Carnham Road, Fine Flower, NW of Grafton, Feb 2001, *Bean 17340* (BRI, NSW); Carnham Road, Fine Flower, NW of Grafton, Sep 2001, *Bean 17950* (BRI, MEL, NSW); Wave Hill Station, Jan 2003, *Specht s.n.* (NSW 619948).

***Distribution and habitat*:** *Pimelea rupestris* is known from just three locations; Mt Widgee in south-east Queensland, and Fine Flower and Wave Hill station in north-east New South Wales (**Map 4**). It is confined to serpentinite outcrops in hilly or mountainous terrain, with shallow or skeletal soil.

***Phenology*:** Flowers and fruits are recorded for January, February, March and September.

***Affinities*:** *Pimelea rupestris* is not obviously related to any other species. The dioecious habit, the floral tube that lacks circumscissile dehiscence, and the conspicuous hairs on the inner surface of the floral tube are diagnostic. It is perhaps reminiscent of *P. altior*, but differs from that species by the dioecious habit, the alternate leaves, the many more flowers per inflorescence and the acute sepals.

***Notes*:** The populations from New South Wales differ in minor ways from those at the type locality; the stem indumentum is not as dense, with longer individual hairs, and the hairs on the floral tube are longer.

***Conservation status*:** Nothing is known about the Wave Hill subpopulation of *Pimelea rupestris*. Fewer than 20 plants are known at Fine Flower in the Gordonbrook Serpentinite Belt, but that formation is about 25 km long (Holland 2017), so it is likely that further subpopulations could be located. At Mt Widgee, the subpopulation is estimated at 100–200 plants, occupying about 10 hectares. Using the Red List criteria (IUCN 2012), a conservation status of **Endangered** is recommended (criterion D).

***Etymology*:** From the Latin *rupestris*, 'of rocks, living in rocky places'. This refers to the habitat of the species.

17. Pimelea sericostachya F.Muell., *Fragm.* 4: 162 (1864); *Pimelea sericostachya* var. *sericostachya*, Benth., *Fl. Austral.* 6: 24 (1873); *Banksia sericostachya* (F.Muell.) Kuntze, *Revis. Gen. Pl.* 2: 583 (1891); *Pimelea sericostachya* subsp. *sericostachya*, Threlfall, *Brunonia* 5: 149 (1983). **Type:** Queensland. South Kennedy District: Sellham [Sellheim] River, [1864], *E.M. Bowman 100* (lecto: MEL 58313, *fide* Threlfall (1983: 148); isolecto: MEL 58314, MEL 58315).

Pimelea sp. (Hughenden D.A.Halford Q242); Pollock (2010), Bean (2016).

Perennial shrub, 50–100 cm high, gynomonoecious. Young stems densely hairy, longest hairs 0.5–1.4 mm long, coarse, shiny and transparent, appressed. Leaves alternate, internodes 4–28 mm long; petioles 0.7–1.5 mm long. Lamina oblanceolate, or narrowly-elliptic, 14–32 mm long, 3–9 mm wide, 3.6–7.6 times longer than wide, with only midrib visible, apex acute, margins flat. Upper surface of lamina glabrous or hairy; hairs slender, longest ones 0.4–0.8 mm long, *c.* 0.025 mm wide, antrorse or appressed; very sparse, sparse, or moderately dense. Lower surface of lamina hairy; hairs appressed, coarse, shining, transparent, longest hairs 1–1.7 mm long, *c.* 0.05 mm wide, sparse to moderately dense. Inflorescence terminal, spicate, with 33–95 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis linear, at maturity 30–250 mm long, moderately hairy; peduncle length 10–24 mm long. Flowers bisexual or female. Pedicels 4–6(–8) per cm of rachis, each 0.3–0.8 mm long. Floral tube 5.5–6.4 mm long at anthesis, yellow-green or yellow; outer surface with hairs sparse, moderately dense, or dense, antrorse, 1–1.4 mm long; inner surface glabrous. Sepals spreading at *c.* 45°, 1.5–2.1 mm long, apex obtuse, inner surface glabrous, outer surface sparsely hairy. Staminal filaments 0.05–0.1 mm long; anthers 1.1–1.3 mm long, dehiscence introrse. Style not or scarcely exserted. Fruit orientation at right angles to rachis. Seed ovoid, 3.5–4 mm long, dark brown, surface colliculate.

***Additional selected specimens examined*: Queensland.** Cook District: Morgans Folly, Blackdown Station, May 1999, *Forster PIF24357 & Booth* (BRI, CNS); Blackbraes NP, 13 km NNW of Blackbraes old homestead, 185 km N of Hughenden, Jun 2013, *Leitch QDA002403* (BRI); Pannikin Springs area, Jan 1993, *Bean 5613 & Forster* (BRI); Blackdown Station Road, 37 km from

Rookwood, Jun 1996, *Gray 6769* (BRI); Donkey Spring Creek, Bulleringa NP, 80 km NW of Mt Surprise, Apr 1998, *Forster PIF22507 & Booth* (BRI, DNA, MEL); 51 km along Almaden road, from junction with Gulf development road near Mt Surprise, May 2004, *McDonald KRM2598* (BRI). BURKE DISTRICT: 68 km N of Hughenden, May 1990, *Halford Q242* (BRI, PERTH). NORTH KENNEDY DISTRICT: Taravale, *c.* 1.5 km before the homestead, May 2009, *Jensen 1755* (BRI); 19 km W of Paluma towards Hidden Valley, Aug 1993, *Cumming 12555* (BRI); *c.* 7.5 km NW of Hidden Valley township, along powerline road, Apr 2001, *Pollock ABP1057 & Turpin* (BRI); Herveys Range Developmental Road, 76 km W of Townsville, Jul 1989, *Jobson 694* (BRI, MEL); Castle Hill, Townsville, Feb 1992, *Bean 4050* (BRI, MEL); 6 km SE of Glencoe homestead on road to Killarney homestead, 101 km W of Charters Towers, Sep 1992, *Thompson HUG40 & Sharpe* (BRI); Near Charters Towers, May 1962, *Gittins 491* (CANB); Ravenswood, Mar 1943, *Blake 14869* (BRI); Charters Towers, *s.dat.*, *Plant s.n.* (BRI [AQ97868]); Fanning River Station, Aug 1989, *Godwin C3699* (BRI); The Bluff, E of Mingela, *c.* 70 km S of Townsville, Sep 1989, *Cumming 9352* (BRI); Top of peak, Bogie Range, Sep 1950, *Smith 4534* (BRI); Eastern slopes of Mt Kelly, *c.* 14 km SW of Ayr, May 2009, *Bean 28834* (BRI); Round Mountain, 3 km W of Ross River Dam, Townsville, Jun 1991, *Bean 3299* (BRI); 34 km N of Pentland, Jul 1975, *Chapman 1343* (BRI, CANB, K, NT, PERTH). SOUTH KENNEDY DISTRICT: W escarpment Dicks Tableland, *s.dat.*, *Pearson SP596* (BRI).

***Distribution and habitat*:** *Pimelea sericostachya* is endemic to north-east Queensland with a distribution that extends from Bellevue Station (west of Port Douglas) to the Sellheim River, south-east of Charters Towers, and east to the Dicks Tableland, west of Mackay. It occurs mainly away from the coast, except in the Townsville area (**Map 2**). It inhabits hills and ridges in sandy or sandy-loam soil, derived from sandstone or granite.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Typification*:** Under Article 9.9 (McNeill *et al.* 2012), Threlfall's use of the term "holotype" is correctable to "lectotype".

***Affinities*:** *Pimelea sericostachya* is most closely related to *P. leptostachya* (see notes under that species).

***Conservation status*:** *Pimelea sericostachya* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

18. Pimelea simplex F.Muell., *Linnaea* 25: 443 (1853). **Type:** South Australia. Cudnaka [Kanyaka], October 1851, *F. Mueller s.n.* (holo: MEL 58319).

Annual forb, 15–40 cm high, bisexual. Young stems sparsely hairy, hairs slender, somewhat shiny and transparent, appressed to antrorse. Leaves alternate; lamina narrowly-elliptic, with no veins visible or only midrib visible, margins flat. Upper surface of lamina glabrous or hairy; hairs slender, appressed. Lower surface of lamina hairy; hairs appressed, slender, somewhat shiny, transparent, *c.* 0.025 mm wide, sparse. Inflorescence terminal, spicate, leafy bracts absent. Rachis cylindrical, very densely hairy. Flowers bisexual. Floral tube yellow, inner surface glabrous. Sepals erect, apex obtuse, inner surface glabrous, outer surface densely hairy. Anther dehiscence introrse. Style not or scarcely exserted. Seed ovoid, black, surface foveolate.

Two subspecies are recognised and can be distinguished by the following key:

Floral tube hairs 0.6–0.9 mm long; rachis length 3–6 mm. . . . **18b. P. simplex** subsp. **simplex**
Floral tube hairs 1.4–2.8 mm long; rachis length 6–15 mm . . **18a. P. simplex** subsp. **continua**

18a. Pimelea simplex subsp. **continua** (J.M.Black) Threlfall, *Brunonia* 5: 152 (1983); *P. continua* J.M.Black, *Trans. & Proc. Roy. Soc. South Australia* 39: 96 (1915); *P. simplex* var. *continua* (J.M.Black) J.M.Black, *Fl. S. Austral.* 3: 400 (1926). **Type:** South Australia. Ketchowla, NE of Hallett, January 1911, *s. coll.* (holo: MEL 50666).

***Illustrations*:** Rye (1990: 162); Fletcher *et al.* (2009: 14, 15).

Longest stem hairs 0.8–1.1 mm long. Leaves internodes 2–18 mm long; petioles 0.3–0.5 mm long. Lamina 7–23 mm long, 1.7–2.5 mm wide, 4.1–11 times longer than wide, apex

obtuse or acute. Upper surface with longest hairs 0.3–0.5 mm long, *c.* 0.025 mm wide; sparse. Lower surface of lamina with longest hairs 0.5–0.7 mm long. Inflorescence with 35–100 flowers produced (= number of persistent pedicels). Rachis at maturity 6–15 mm long; peduncle length 1–10 mm long. Pedicels 60–120 per cm of rachis, each 0.4–0.7 mm long. Floral tube 3.7–5.3 mm long at anthesis; outer surface with hairs very dense, antrorse to spreading, 1.4–2.8 mm long. Sepals 0.5–0.7 mm long. Staminal filaments 0.3–0.5 mm long; anthers 0.65–0.75 mm long. Seed 2.7–3 mm long.

***Additional selected specimens examined* (from 101 specimens): Queensland.** Gregory North District: *c.* 165 km WSW of Longreach, Aug 1989, *Pedley 5469* (AD, BRI, DNA, MO); Tonkoro Station, 2.4 km from Gun Creek Well at bearing of 337 degrees, Aug 2013, *Pennay CP546 & Richter* (BRI); Winderere, 15 km W of Winton, Aug 2007, *Sanders PP07/186* (BRI); 44 km by road W of Winton on road to Boulia, Sep 2005, *Thomas 2943 & Halford* (BRI). Mitchell District: Mt Victoria, 55 km W of Longreach, Aug 2007, *Faggotter JM1725* (BRI); Noonbah Lake Yards Holding Paddock, 8.5 km W of Noonbah homestead, *c.* 150 km SW of Longreach, Jul 2008, *Milson JM1732* (BRI); Adalonga, 70 km W of Longreach, Aug 2010, *Neldner 4582* (BRI, PE); *c.* 7 km N of Jundah, May 1988, *Nicholson & Novelly 75* (BRI); Mayland, 32 km NE of Muttaburra, *s.dat.*, *Shield s.n.* (BRI [AQ4206]); Tancred, 136 km S of Torrens Creek, Jun 1989, *Bolton MPB992B* (BRI). Gregory South District: WARLUS I, Site 187, 240 km NW of Noccundra, Jul 1971, *Boyland 3087* (BRI); Thylungra, *c.* 75 miles [121 km] NW of Quilpie, Oct 1955, *Everist 5752* (BRI). Warrego District: Clover Downs, 45 km SE of Cunnamulla, Sep 2007, *Silcock PP07/215* (BRI); 33 km NE Charleville, Oct 2008, *Burton PP08/428* (BRI); 40 km E of Cunnamulla on Balonne Highway, Sep 2003, *McKenzie RAM03/187* (BRI); 70 km SSE of Cunnamulla, just N of Thurrulgoona Road, E of house, Oct 2008, *Silcock PP08/250* (BRI). Maranoa District: 120 km SW of Bollon on road to Noorama from Murra Murra road, Oct 2008, *Silcock PP08/251a* (BRI).

***Distribution and habitat*:** *Pimelea simplex* subsp. *continua* occurs in Queensland from Muttaburra and Winton in the north to the New South Wales border south-east of Cunnamulla (**Map 6**). It also occurs in South Australia and far-western NSW. Soils vary from red sandy loams to heavy grey clays. It is often found in treeless areas with *Astrebla* spp., but also may be in communities dominated by *Acacia tephrina* Pedley, *A. cambagei*, *A. aneura* F.Muell. ex Benth. or *Eucalyptus populnea*.

***Phenology*:** Flowers and fruits are recorded from June to January.

***Notes*:** The Queensland specimens of *Pimelea simplex* subsp. *continua* are not a very good match for the type and other South Australian material, as the hairs attached to the floral tube are much longer in Queensland plants. It is possible that there is an unrecognised taxonomic distinction, but more study is required to elucidate the matter.

***Conservation status*:** *Pimelea simplex* subsp. *continua* is a common and widespread subspecies. A conservation status of **Least Concern** is recommended (IUCN 2012).

18b. Pimelea simplex F.Muell. subsp. simplex

***Illustrations*:** Fletcher *et al.* (2009: 14, 15); Rye (1990: 162).

Longest stem hairs 0.6–0.9 mm long. Leaves internodes 2–10 mm long; petioles 0.2–0.6 mm long. Lamina 8–16 mm long, 1.7–3.5 mm wide, 3.9–5.3 times longer than wide, apex obtuse. Upper surface with longest hairs 0.3–0.4 mm long, *c.* 0.025 mm wide; very sparse. Lower surface of lamina hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 0.5–0.9 mm long. Inflorescence with 25–50 flowers produced (= number of persistent pedicels). Rachis at maturity 3–6 mm long; peduncle length 0–9 mm long. Pedicels 60–80 per cm of rachis, each 0.3–0.5 mm long. Floral tube 2.3–4.7 mm long at anthesis; outer surface with hairs very dense, antrorse, 0.6–0.9 mm long. Sepals 0.4–1.3 mm long. Staminal filaments 0.2–0.3 mm long; anthers 0.5–0.85 mm long. Seed 2.8–3.1 mm long.

***Additional selected specimens examined*: Queensland.** Warrego District: Minoru, 81 km SSE of Cunnamulla on Thurrulgoonia Road, Sep 2007, *Silcock PP07/219* (BRI); Talbarea, 62 km SSE of Cunnamulla, Sep 2007, *Silcock PP07/216* (BRI); 70 km SSE of Cunnamulla, just N of Thurrulgoona Road, E of house, Oct 2008, *Silcock PP07/216* (BRI); Thurulgoona, Cunnamulla, Sep 2003, *McKenzie RAM03/184* (BRI); 25 km from Adavale, Nov 2006, *Berry BB4A* (BRI). Maranoa District: A few km E of River Road on Surat – Glenmorgan Road, N of road, Sep 2007, *Silcock PP07/217* (BRI); Cambridge Downs, River Road, *c.* 10 km E of Surat, Sep 2007, *Silcock PP07/194* (BRI); 11 km N of St George at junction of Moonie and Carnarvon Highways, Sep 2008, *Silcock &*

Mann PP08/244 (BRI); 10 km E of Surat and 700 m N along River Road, Oct 2007, *Silcock P07/263* (BRI); 120 km SW of Bollon on road to Noorama from Murra Murra road, Oct 2008, *Silcock PP08/251b* (BRI); Wilga Park, St George, Balonne Shire, Jul 1989, *Oliver s.n.* (BISH, BRI [AQ456674], MO, NSW); Basin Downs, 38 km S of Surat, Aug 1990, *Newman s.n.* (BRI [AQ473916]); 19 km W of Hebel at junction of Mundah and Woolabilla Roads, Dec 2001, *Halford Q7706 & Batianoff* (BRI); Koomalah, 37 km S of Dirranbandi, Nov 2004, *Fraser s.n.* (BRI [AQ611715]); 10 miles [16 km] S of Surat on St George Road, Aug 1956, *Everist 5820* (BRI); Carnarvon Highway, 45 miles [75 km] NE of St George, near Donga Creek, Sep 1960, *Everist 6236* (BRI); Carnarvon Highway between St George & Surat at junction with Moonie Highway (Dalby turnoff), Willathaw Plain, Sep 2003, *Eddie Lot52* (BRI).

***Distribution and habitat*:** In Queensland *Pimelea simplex* subsp *simplex* is found from Surat to Hebel, and west to Cunnamulla, with an apparently isolated occurrence near Adavale (**Map 5**). It also occurs in western New South Wales and semi-arid South Australia. It grows on reddish-brown or cracking brown to grey clay soils, in communities dominated by *Eucalyptus populnea* or *Acacia cambagei* R.T.Baker, or in *Astrebla* grassland.

***Phenology*:** Flowers and fruits are recorded from July to November.

***Notes*:** *Pimelea simplex* subsp. *simplex* differs from subsp. *continua* mainly in the length of the hairs on the floral tube (0.7–0.9 mm for subsp. *simplex*; 1.4–2.8 mm for subsp. *continua*); there does not appear to be a clear separation in any other character. The distributions of subsp. *simplex* and subsp. *continua* in Queensland are largely separate, but they do overlap in the Thurulgoona area S of Cunnamulla, and SW of Bollon. In these two areas, both subspecies have been collected from the same GPS location, apparently without intergradation or hybridisation.

***Conservation status*:** *Pimelea simplex* subsp. *simplex* is a common and widespread subspecies. A conservation status of **Least Concern** is recommended (IUCN 2012).

19. Pimelea strigosa Gand., *Bull. Soc. Bot. France* 60: 419 (1913). **Type:** New South Wales. Warrumbungle Ranges, October 1899, *Forsyth s.n.* (holo: ?LY, *n.v.*; iso: NSW 120783).

Perennial shrub, 20–60 cm high, gynomonoecious. Young stems sparsely to densely hairy, longest hairs 1.2–1.7 mm long, thick, shiny and transparent, antrorse. Leaves alternate (except near base of plant), internodes 2–23 mm long; petioles 1–2 mm long. Lamina elliptic, 19–43 mm long, 4.8–9.5 mm wide, 2.9–5 times longer than wide, with only the midrib visible, apex acute, margins recurved. Upper surface of lamina with hairs sparse to moderately dense; hairs slender, longest ones 0.3–0.7 mm long, *c.* 0.025 mm wide, appressed to antrorse. Lower surface of lamina hairy; hairs moderately dense, appressed to antrorse, thick, very shiny, transparent, longest hairs 0.8–1.3 mm long, *c.* 0.05 mm wide. Inflorescence terminal or axillary, capitulate, with 18–23 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis globose, at maturity 2–3 mm long, very densely hairy; peduncle length 10–32 mm long. Some flowers bisexual, some female. Pedicels 0.3–0.5 mm long. Floral tube 4.1–5.2 mm long at anthesis, yellow-green to yellow; outer surface with hairs dense, appressed to antrorse, 0.6–0.9 mm long; inner surface glabrous. Sepals erect, 1.3–1.7 mm long, apex obtuse or acute, inner surface glabrous, outer surface densely hairy. Staminal filaments 0.05–0.1 mm long; anthers 0.7–0.8 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, *c.* 2.9 mm long, black, surface foveolate.

***Additional selected specimens examined*: Queensland.** Leichhardt District: Kareela, S of Springsure, Aug 1990, *O'Keeffe 931* (BRI); Carnarvon Gorge, May 1962, *Johnson 2397* (BRI); Robinson Gorge NP, upstream section of main gorge in Get Down area, Sep 1992, *Forster PIF11298 & Sharpe* (BRI, MEL); SF46, *c.* 70 km W of Taroom, Sep 2002, *Bean 19313* (BRI, MEL). Maranoa District: East Maranoa River, Mt Moffatt NP, Dec 1997, *Bean 12936* (BRI, MEL). Darling Downs District: Upper Freestone, NE of Warwick, Nov 2003, *Bean 21171* (BRI); Warwick, *s.dat.*, *Beckler s.n.* (MEL 50795); Warwick, Mar 1911, *Boorman s.n.* (BRI [AQ97852]); Connolly Dam, S of Warwick, Oct 1996, *Bean 10865* (BRI, MEL, NSW); Cherribah, *c.* 25 km SSE of Warwick, Oct 2008, *Cooper CSP04* (BRI); Old Stanthorpe Road, between Dalveen and Warwick, Nov 2001, *Halford Q7053* (BRI, HO); Ballandean cattle station, Red Rock Gorge, Jan 1940, *Smith 735* (BRI); Sundown NP, northern end, Feb 2004, *Haselgrove 275* (BRI).

***Distribution and habitat*:** *Pimelea strigosa* occurs in Queensland and New South Wales. In Queensland it is found mainly in the southern Darling Downs district, in the Warwick – Stanthorpe area, but there are some disjunct occurrences between Taroom and Springsure (**Map 5**). It also occurs in northern New South Wales, west of the Great Divide. It inhabits sandy soils derived from granite or sandstone, often in riparian or alluvial situations.

***Phenology*:** Flowers and fruits are recorded for nearly every month of the year.

***Affinities*:** *Pimelea strigosa* can easily be confused with *P. curviflora*, a species of similar appearance. *P. strigosa* is most readily distinguished from the latter by the long (10–32 mm) peduncles, and can also be separated by the mainly alternate leaves, the shorter stem hairs, the hairy upper leaf surface, the shorter hairs on the lower leaf surface, and the shorter anthers.

***Conservation status*:** *Pimelea strigosa* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

20. Pimelea trichostachya Lindl. in T.L.Mitchell, *J. Exped. Trop. Australia* 355 (1848). *Calyptrostegia trichostachya* (Lindl.) Walp., *Ann. Bot. Syst.* 3: 325 (1852); *Banksia trichostachya* (Lindl.) Kuntze, *Revis. Gen. Pl.* 2: 583 (1891). **Type:** [Queensland] subtropical New Holland [near Camp XXXI], 18 October 1846, *W. Stephenson s.n.* (holo: CGE, *n.v., fide* Threlfall (1983)).

***Illustrations*:** Rye (1990: 162); Moore (2005: 430); Fletcher *et al.* (2009: 14, 15);

Annual forb, 20–60 cm high, bisexual. Young stems sparsely hairy, longest hairs 0.8–1 mm long, slender, somewhat shiny and transparent, appressed to antrorse. Leaves alternate, internodes 3–17 mm long; petioles 0.4–0.8 mm long. Lamina narrowly-elliptic, 4–12 mm long, 0.7–1.3 mm wide, 4–8.8 times longer than wide, with no veins visible, apex obtuse or acute, margins flat. Upper surface of lamina glabrous or rarely hairy; hairs slender, longest ones 0.25–0.45 mm long, *c.* 0.025 mm wide, appressed; very sparse. Lower surface of lamina glabrous or hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 0.5–0.8 mm long, *c.* 0.025 mm wide, sparse. Inflorescence terminal, spicate, with 45–85 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis linear, at maturity 20–120 mm long, moderately densely hairy; peduncle length 2–20 mm long. Flowers bisexual. Pedicels 7–20 per cm of rachis, each 0.7–1 mm long. Floral tube 3.1–4.3 mm long at anthesis, yellow, but obscured by white hairs; outer surface with two layers of hairs; a very dense layer of short patent hairs 0.2–0.3 mm long, and a moderately dense layer of patent hairs, 1.5–2 mm long; inner surface glabrous. Sepals erect, 0.4–0.6 mm long, apex obtuse, inner surface glabrous, outer surface moderately densely hairy. Staminal filaments *c.* 0.5 mm long; anthers 0.45–0.55 mm long, dehiscence introrse. Style not or scarcely exserted. Seed ovoid, 2.4–2.5 mm long, black, surface foveolate.

***Additional selected specimens examined*: Queensland**. Burke District: 43 miles [69 km] NE of Camooweal on road to Thorntonia, Jul 1974, *Ollerenshaw PO1309 & Kratzing* (BRI). South Kennedy District: Glen Innes, NW of Alpha, Jul 2003, *Fensham 4894* (BRI). Gregory North District: *c.* 3 km SW of Green Tank, Diamantina NP, SE of Boulia, SW of Winton, Sep 2005, *Mostert MM306* (BRI). Mitchell District: Erne, *c.* 45 miles [75 km] NNE of Blackall, Jun 1939, *Everist 1812* (BRI); Lancevale, 90 km N of Blackall, Feb 2008, *Burton PP08/165* (BRI); 43 km NE of Aramac, Jul 2008, *House PP08/163* (BRI); 47 km SW of Jericho, near Blendon Station, Sep 2000, *Thompson JER260* (BRI); Narbethong, Yalleroi, Blackall Shire, Aug 1990, *Cottam 1343* (BRI); 12 km E of Jundah, 2 km W of Paradise house, Dec 2008, *Milson JM1737* (BRI). Gregory South District: 20.2 km WSW of Eromanga, on Cooper Developmental Road, Aug 2010, *Bean 30020* (BRI); 122 km W of Birdsville on track to Poeppel Corner, Simpson Desert NP, Sep 1998, *Halford Q3621* (BRI). Warrego District: Mount Maria, [in 1876], *Bailey s.n.* (BRI [AQ86130]); Bulloo Downs, *c.* 110 km SW of Thargomindah, Oct 2000, *Elsworth BDEA12* (BRI); 271.2 km by road W of St George on road to Cunnamulla, Sep 2005, *Thomas 2792* (BRI); Lake Wyara, Currawinya NP, Oct 1991, *Williams 91012* (BRI); 12.5 km S of Charleville, Sep 1987, *Wilson 477* (BRI); Tinderry, Feb 1960, *Johnson 1570* (BRI); Charleville, Jan 1931, *Hubbard 6139* (BRI); 36 miles [60 km] SE of Quilpie on Cowley Station, Feb 1972, *Kelly s.n.* (BRI [AQ1720]). Maranoa District: Spring Hill, 50 km NNW of Roma, Oct 1986, *Newman 3* (BRI); Barlin, NE of Mitchell, Dec 1990, *Schefe B1* (BRI); 25.1 km N

of Womblebank, NW of Injune, Oct 1998, *Bean 14325* (BRI, MEL, NSW); Miltonise, *c.* 30 miles [48 km] W of St George, Mar 1936, *Blake 10801* (BRI); 11 km SE of Gradule, W of Goondiwindi, Sep 2001, *Bean 17837* (BRI). Darling Downs District: 1 km E of Hannaford Road intersection with Tara to Glenmorgan Road, Sep 2007, *Silcock PP07/211* (BRI); Moonie River, *c.* 5 miles [8 km] WSW of Southwood, Sep 1958, *Johnson 588* (BRI); Near E boundary of Bendidee SF, *c.* 40 km NE of Goondiwindi, Dec 2007, *Bean 26993* (BRI).

***Distribution and habitat*:** *Pimelea trichostachya* is a very widespread species in Queensland in areas west of the Great Dividing Range, extending as far east as Milmerran, and north to Aramac, with an outlier north-west of Mount Isa (**Map 1**). It also occurs widely in all other mainland states and territories. It grows in flat or undulating terrain in red or brown sand or sandy-loam. Commonly associated tree species include *Eucalyptus melanophloia* F.Muell., *E. populnea, Acacia aneura, Angophora melanoxylon* R.T.Baker, *Acacia excelsa* Benth. and *Callitris glaucophylla* Joy Thomps. & L.A.S.Johnson.

***Phenology*:** Flowers and fruits may be found at any time of the year.

***Notes*:** *Pimelea trichostachya* is distinctive by virtue of the narrow leaves, annual habit, long patent hairs on the floral tube, linear rachis and short anthers.

***Conservation status*:** *Pimelea trichostachya* is a common and widespread species. A conservation status of **Least Concern** is recommended (IUCN 2012).

21. Pimelea umbratica Meisn. in DC., *Prodr.* 14: 510 (1857). **Type:** [Queensland]. Base of Great Dividing Chain, W of Moreton Bay, in 1827, *A. Cunningham s.n.* (holo: G-DC).

***Illustrations*:** Rye (1990: 171); Leiper *et al.* (2008: 451).

Perennial shrub, 100–500 cm high, gynomonoecious or gynodioecious. Young stems moderately to densely hairy, longest hairs 0.3–0.6 mm long, thin, shiny and transparent or white and opaque, appressed. Leaves strictly opposite, internodes 2–12 mm long; petioles 1–1.8 mm long. Lamina narrowly elliptic to elliptic, 12–27 mm long, 4–7 mm wide, 3–5.3 times longer than wide, midrib visible, lateral veins sometimes faintly visible; apex acuminate or occasionally acute; margins flat or recurved. Upper surface of lamina glabrous or hairy; hairs slender, longest ones 0.2–0.35 mm long, *c.* 0.01 mm wide, appressed; very sparse. Lower surface of lamina hairy; hairs appressed, slender, somewhat shiny, transparent, longest hairs 0.3–0.5 mm long, *c.* 0.01 mm wide, sparse. Hairs on leaf margins longer and thicker (0.6–0.9 mm long and *c.* 0.25 mm wide). Inflorescence terminal, capitulate, with 8–14 flowers produced (= number of persistent pedicels), leafy bracts absent. Rachis globular, at maturity 1–2 mm long, densely hairy; peduncle length 0–1.5 mm long. Some flowers bisexual, some female, sometimes produced on the same plant, sometimes on separate plants. Pedicels 0.6–0.8 mm long. Floral tube 4.2–6.8 mm long at anthesis, white or yellow-green; outer surface with hairs moderately dense to dense, appressed, longer ones 0.3–0.45 mm long; inner surface glabrous or hairy. Sepals widely spreading, 1.7–3 mm long, apex acute, inner surface glabrous, outer surface sparsely hairy. Staminal filaments 0.05–0.1 mm long; anthers 1.4–1.8 mm long, dehiscence introrse. Style not or scarcely exserted. Seeds ovoid, *c.* 3.7 mm long, black, surface smooth.

***Additional selected specimens examined*: Queensland.** Darling Downs District: Mt Cordeaux, below summit, Dec 1981, *Guymer 1664 & Jessup* (BRI, CANB, NSW); Mt Cordeaux, Great Dividing Range, *c.* 2 km along walking track to summit, Dec 1986, *Beesley 795 & Ollerenshaw* (BRI, CANB, PERTH); Mt Mitchell, Cunningham's Gap, Aug 1992, *Forster PIF11099 & Reilly* (BRI, MEL); Spicers Peak, E peak, Main Range NP, Sep 1995, *Forster PIF17667 et al.* (BRI); Mt Colliery area, NE of Killarney, adjacent to Main Range NP, Mar 2015, *Forster PIF42128 et al.* (BRI, MEL); Mt Bell, Main Range NP, above Teviot Falls, Aug 1998, *Leiper s.n.* (BRI [AQ664039]); Wilsons Peak, Aug 1994, *Forster PIF15697* (BRI, NSW). Moreton District: Top of Buchanan's Fort, Christmas Creek area, Sep 1995, *Forster PIF17679 & Leiper* (BRI).

***Distribution and habitat*:** *Pimelea umbratica* has a restricted distribution in south-east Queensland on mountains close to the New South Wales border, extending as far north as Mt Cordeaux (**Map 4**). It is also known from Mebbin Rock in far north-eastern New South Wales. It grows on skeletal rhyolite mountaintops and slopes, in shrubland or low open woodland.

***Affinities*:** *Pimelea umbratica* is closely related to the recently named *P. cremnophila* L.M.Copel. & I.Telford from northern New South Wales (Copeland & Telford 2006). Among the Queensland species, it seems closest to *P. aquilonia* (see notes under that species).

***Phenology*:** Flowers and fruits have been recorded for March, August, September and December.

***Conservation status*:** *Pimelea umbratica* is known from seven subpopulations with an estimated area of occupancy of 10 km^2. Most subpopulations are within conservation reserves, and there are no current perceived threats. Therefore a conservation status of **Least Concern** is recommended.

Key to the Queensland taxa of *Pimelea*

1 Internodes and lower leaf surface with at least a sparse covering of hairs (visible with a hand lens), and often conspicuously hairy **2**
1. Internodes and leaves glabrous (sometimes hairs present at the nodes) **28**

2 Both sides of the leaf very densely hairy, hairs obscuring the surface **3**
2. Hairs not obscuring the surface of the leaf (under magnification), at least on the upper side (section *Epallage*) **4**

3 Inflorescence hemispherical to globose, with 6–12 involucral bracts . . . . . **P. penicillaris**
3. Inflorescence cylindrical, involucral bracts absent . . . . . **P. amabilis**

4 Longest rachis 1–18 mm long (at fruiting stage or after all flowers/fruits have fallen) **5**
4. Longest rachis 18–250 mm long (at fruiting stage or after all flowers/fruits have fallen) **21**

5 Leaves alternate, except at base of plant **6**
5. Leaves opposite to sub-opposite throughout **15**

6 Longest stem hairs > 1.2 mm long **7**
6. Longest stem hairs < 1.2 mm long **9**

7 Peduncles 10–32 mm long . . . . . **19. P. strigosa**
7. Peduncles 0–1.5 mm long **8**

8 Upper leaf surface glabrous; inflorescences terminal; seeds 2.8–2.9 mm long . . . . . **7. P. curviflora**
8. Upper leaf surface conspicuously hairy; inflorescences lateral; seeds 3.4–3.8 mm long . . . . . **5. P. chlorina**

9 Largest leaves 13–24 mm wide . . . . . **11. P. latifolia**
9. Largest leaves 1.7–14 mm wide **10**

10 Longest rachises cylindrical (3–)4–15 mm long (at fruiting stage or after all flowers/fruits have fallen); petioles 0.2–0.6 mm long; hairs on the floral tube 0.7–2.8 mm long **11**
10. Longest rachises globose to ellipsoidal (at fruiting stage or after all flowers/fruits have fallen), 1–4 mm long; petioles 0.7–2.8 mm long; hairs on the floral tube 0.2–0.6 mm long **12**

11 Floral tube hairs 0.6–0.9 mm long; rachis length 3–6 mm . . **18b. P. simplex** subsp. **simplex**
11. Floral tube hairs 1.4–2.8 mm long; rachis length 6–15 mm . . **18a. P. simplex** subsp. **continua**

12 Pedicels 40–80 per inflorescence; floral tube 3–4.4 mm long, not splitting; inner surface of sepals sparsely hairy; anthers 1–1.2 mm long . . . . . **16. P. rupestris**
12. Pedicels 3–18 per inflorescence; floral tube 4.5–8.8 mm long, circumscissile; inner surface of sepals glabrous; anthers 1.8–2.8 mm long **13**

13 Petioles 1.5–2.8 mm long; lamina with 8–12 pairs of lateral veins; lamina margins recurved . . . . . **15. P. plurinervia**
13. Petioles 0.7–1 mm long; lamina with only midrib visible, or with 1–5 pairs of lateral veins; lamina margins flat **14**

14 Hairs on lower leaf surface appressed, sparse, 0.25–0.6 mm long; hairs on floral tube 0.2–0.3 mm long . . . . . **12b. P. leptospermoides** subsp. **leptospermoides**
14. Hairs on lower leaf surface antrorse to patent, dense, 0.8–0.9 mm long; hairs on floral tube 0.4–0.6 mm long . . . . . **12a. P. leptospermoides** subsp. **bowmanii**

15 Peduncles 0–3 mm long at fruiting stage **16**
15. Peduncles 4–28 mm long at fruiting stage **20**

16 Leaves strictly opposite **17**
16. At least some leaf pairs sub-opposite, separated by 1–5 mm on stem **18**

17 Stems hairs appressed; pedicels 8–14 on each rachis; floral tube 4.2–6.8 mm long; sepals acute . . . . . **21. P. umbratica**
17. Stems hairs antrorse; pedicels 3–4 on each rachis; floral tube 9.7–12 mm long; sepals obtuse . . . . . **4. P. aquilonia**

18 Lamina 2.5–6 mm wide, upper surface glabrous . . . . . **7. P. curviflora**
18. Lamina 8–23 mm wide, upper surface hairy **19**

19 Lamina 33–82 mm long; sepals 3.1–4 mm long, acute; floral tube 8.5–11 mm long . . . . . **10. P. gigandra**
19. Lamina 14–38 mm long; sepals 0.9–1.6 mm long, obtuse; floral tube 5.2–8.2 mm long . . . . . **1. P. altior**

20 Longest stem hairs 0.6–0.8 mm long, appressed; upper leaf surface glabrous; pedicels 12–18 on each rachis . . . . . **9. P. fugiens**
20. Longest stem hairs 1.8–2.6 mm long, antrorse or patent; upper leaf surface hairy; pedicels 24–45 on each rachis . . . . . **14. P. mollis**

21 Rachis readily visible between the persistent pedicels (pedicels 2–20 per cm at midpoint of rachis) **22**
21. Rachis obscured by tightly packed persistent pedicels (pedicels 20–90 per cm at midpoint of rachis) **25**

22 Annual herbs; leaves 0.7–2.8 mm wide; sepals 0.4–0.8 mm long **23**
22. Perennial shrubs; leaves 3–9 mm wide; sepals 0.8–2.1 mm long **24**

23 Hairs on the floral tube 0.3–0.5 mm long, appressed; 17–42 pedicels per inflorescence . . . . . **8. P. elongata**
23. Hairs on the floral tube 1.5–2 mm long, patent; 45–85 pedicels per inflorescence . . . . . **20. P. trichostachya**

24 Floral tube 4.2–5.4 mm long, with longest hairs 1–1.4 mm long; sepals 1.5–2.1 mm long . . . . . **17. P. sericostachya**
24. Floral tube 3.1–3.9 mm long, with longest hairs 0.4–0.6 mm long; sepals 0.8–1.2 mm long . . . . . **13. P. leptostachya**

25 Leaves obovate, 13–24 mm wide; longest stem hairs 0.6–1 mm long, antrorse to patent; floral tube white, with longest hairs 0.2–0.5 mm long . . **11. P. latifolia**
25. Leaves elliptic to narrowly-elliptic, 2–11 mm wide; longest stem hairs 1.2–2.5 mm long, appressed; floral tube yellow-green to yellow, with longest hairs 0.7–1.9 mm long **26**

26 Petioles 1.5–1.8 mm long; lower leaf surface with sparse to moderately dense hairs, the longest ones 2.2–2.7 mm long . . . . . **3. P. approximans**
26. Petioles 0.3–1.5 mm long; lower leaf surface with dense to very dense hairs, the longest ones 0.8–2.1 mm long **27**

27 Hairs on the upper leaf surface 0.7–1.5 mm long; anthers 1–1.1 mm long . . . **2. P. amabilis**
27. Hairs on the upper leaf surface 0.3–0.6 mm long; anthers 1.1–1.3 mm long . . . . . **6. P. confertiflora**

28 Largest leaves 35–70 mm long **29**
28. Largest leaves 10–35 mm long **31**

29 Inflorescence hemispherical, with several involucral bracts; flowers white. . . . . **P. ligustrina** subsp. **ligustrina**
29. Inflorescence cylindrical; involucral bracts absent; flowers red **30**

30 Leaves 1.5–3(–3.5) times longer than broad; hairs on fruit 4–6 mm long; longest hairs on upper part of floral tube 2–3 mm long, antrorse . . . . . **P. decora**
30. Leaves 3–7 times longer than broad; hairs on fruit 1.5–2.5 mm long; upper part of floral tube with longest hairs 0.3–1.5 mm long, patent . **P. haematostachya**

31 Involucral bracts 2; fruits fleshy **32**
31. Involucral bracts 4; fruits dry **33**

32 Floral tube hairy throughout . . . . . **P. microcephala** subsp. **microcephala**
32. Floral tube glabrous . . . . . **P. neoanglica**

33 Floral tube with hairs, at least in upper part; involucral bracts free **34**
33. Floral tube glabrous; involucral bracts fused in lower half. **35**

34 Sparse hairs extending to base of floral tube; all bracts glabrous . . . . **P. linifolia** *sens. lat.*
34. Lowest 1–3 mm of floral tube glabrous; at least the upper pair of bracts with ciliate margins . . . . . **P. glauca**

35 Erect herb; flowers white; pedicels 1–4 mm long. . . . . **P. cornucopiae**
35. Prostrate or sprawling herb; flowers red; pedicels 0.2–1 mm long . . . . . **P. sanguinea**

Taxonomic and nomenclatural adjustments for taxa occurring outside of Queensland

Taxonomic amendment is needed for two subspecies of *Pimelea latifolia* proposed by Threlfall (1983), and confined to New South Wales. *P. latifolia* subsp. *hirsuta* differs from *P. latifolia sens. str.* in a number of characters (e.g. much smaller leaves with long hairs, much shorter rachis, sessile inflorescences, shorter floral tubes), and is here reinstated to species rank. *P. latifolia* subsp. *elliptifolia* Threlfall is also very different from *P. latifolia*, but is very similar to *P. hirsuta*. It can perhaps be maintained at subspecies rank under *P. hirsuta*, as it differs from typical *P. hirsuta* by the generally larger leaves, the hairs on the leaves antrorse to appressed (antrorse or spreading in *P. hirsuta sens. str.*), and the flowers often more numerous (5–15) in the inflorescence (2–8-flowered for *P. hirsuta sens. str.*). None of these characters is absolutely diagnostic, but in combination they suggest that a taxonomic distinction should be preserved.

Pimelea hirsuta Meisn. in A.DC., *Prodr.* 14: 513 (1856); *Banksia hirsuta* (Meisn.) Kuntze, *Rev. Gen. Pl.* 2: 583 (1891); *Pimelea latifolia* subsp. *hirsuta* (Meisn.) Threlfall, *Brunonia* 5: 194 (1983). **Type:** New South Wales. Tomah and Newcastle, in 1834, *R. Cunningham s.n.* (lecto [here designated]: K 000900025).

P. hirsuta subsp. *hirsuta* is found from the Nowra area to Newcastle, with an outlier further north at Lansdowne State Forest near Taree. It usually occurs close to the coast.

Pimelea hirsuta subsp. **elliptifolia** (Threlfall) A.R.Bean, **comb. nov.**; *Pimelea latifolia* subsp. *elliptifolia* Threlfall, *Brunonia* 5: 195 (1983). **Type:** New South Wales. junction of Cedar and Deep Creeks, Millfield, 16 September 1954, *E.F. Constable s.n.* (holo: NSW 30784; iso: BRI [AQ522104]).

P. hirsuta subsp. *elliptifolia* is found mainly from Cessnock to Merriwa in the Hunter valley, but also at Glen Davis and Colo River further south.

Pimelea altior is closely related to *P. hirsuta*, but differs from both subspecies by the white flowers (yellow or greenish-yellow flowers for *P. hirsuta*), the opposite to sub-opposite leaves (alternate for *P. hirsuta*); leaves 14–38 mm long (7–14(–20) mm long for *P. hirsuta*), and the rachis 1–2 mm long (1–4 mm long for *P. hirsuta*).

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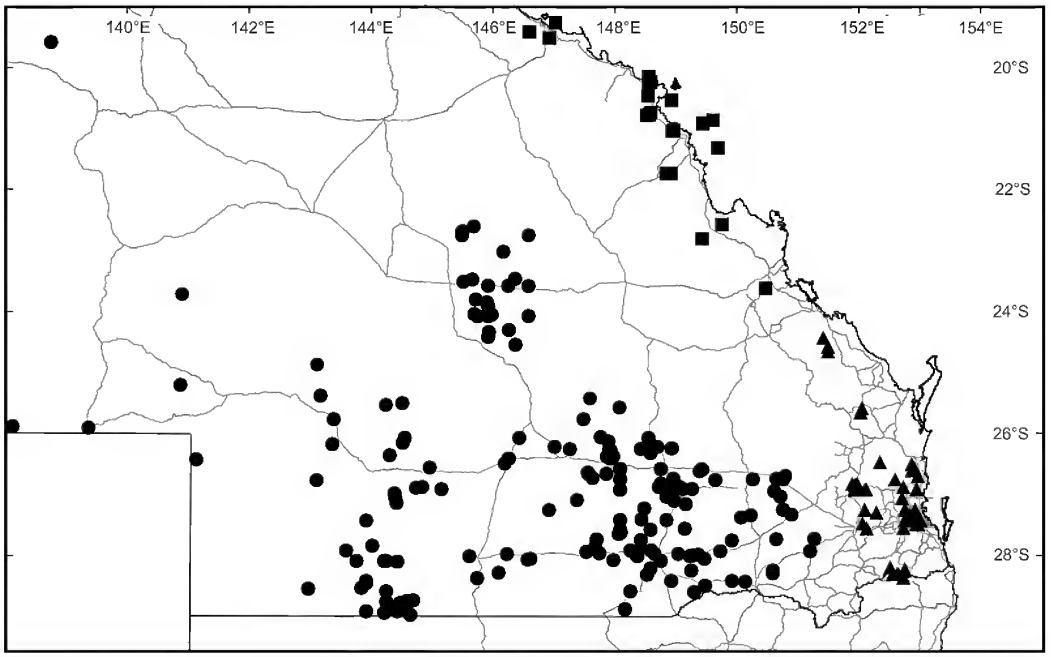
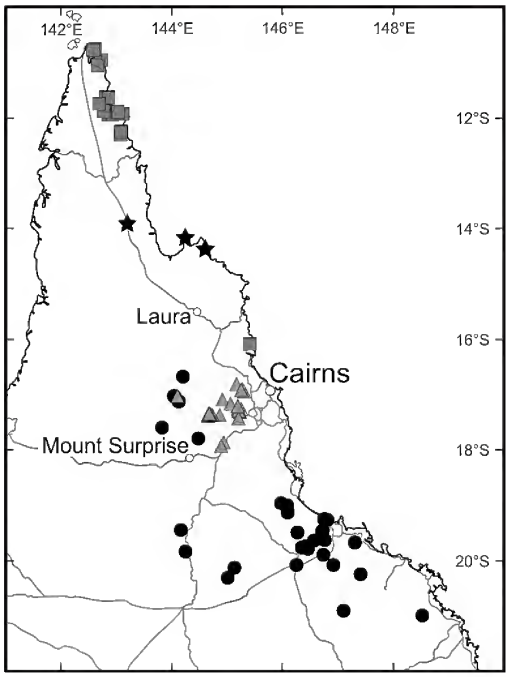
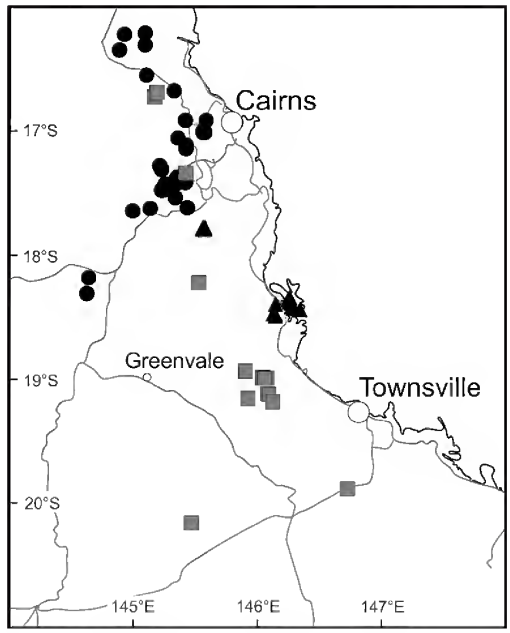


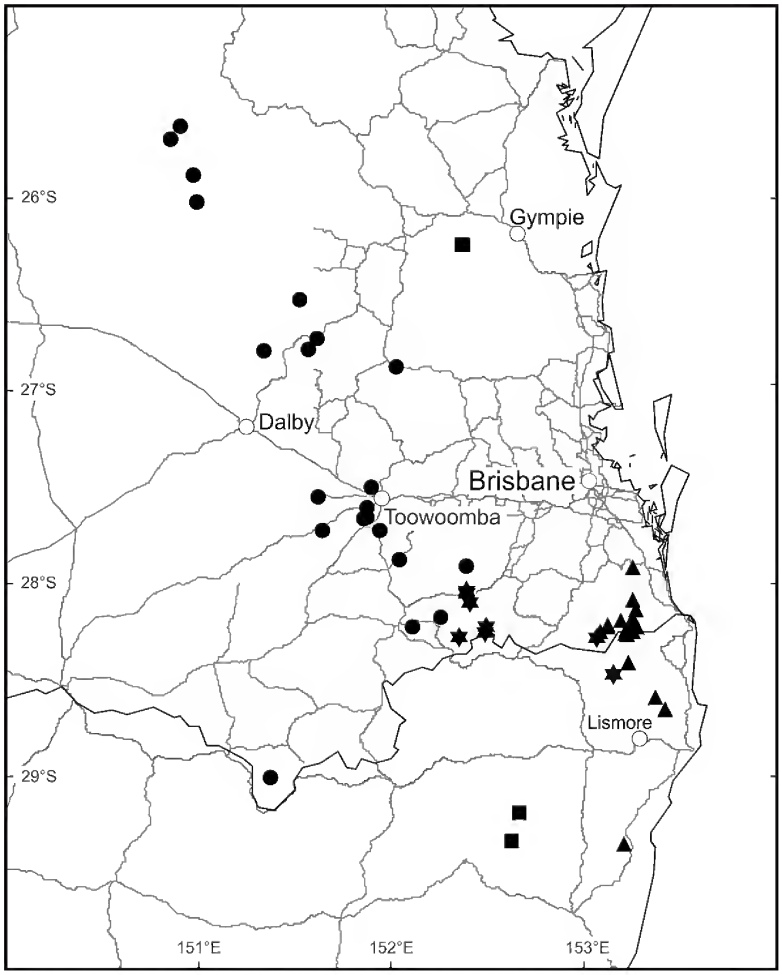
Map 1. Distribution of ***Pimelea altior*** ▲ (Queensland records only), ***P. latifolia*** ■, ***P. trichostachya*** ● (Queensland records only).



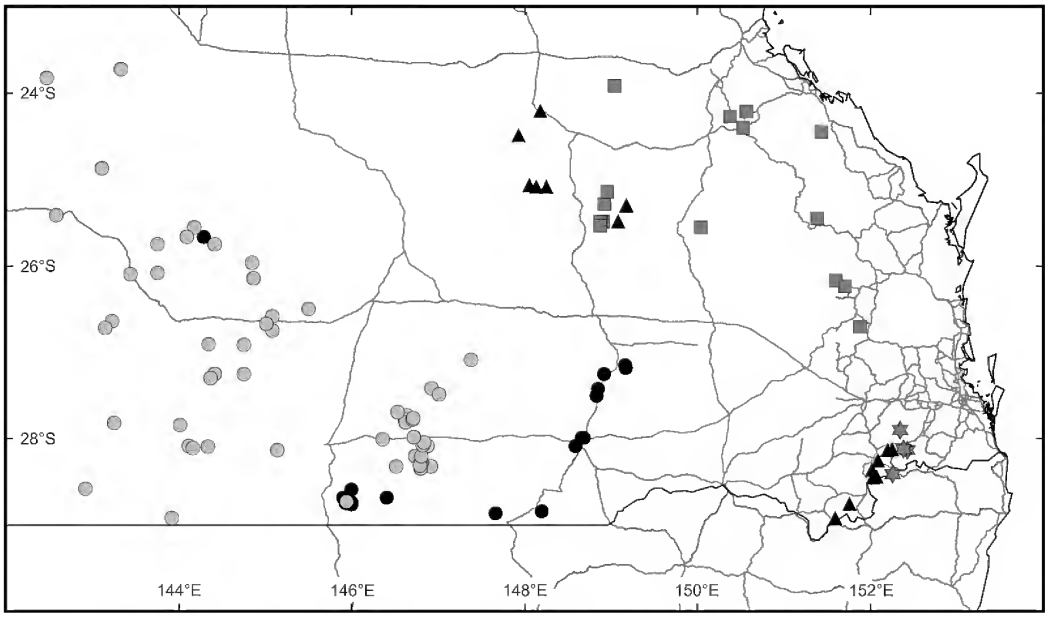
Map 2. Distribution of ***Pimelea amabilis*** ▲, ***P. approximans*** ★, ***P. aquilonia*** ■, ***P. sericostachya*** ●.



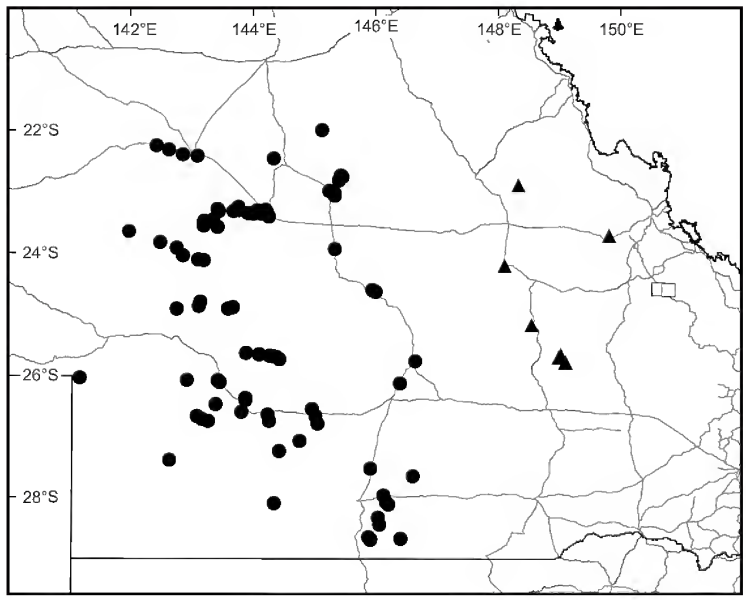
Map 3. Distribution of ***Pimelea chlorina*** ■, ***P. confertiflora*** ●, ***P. plurinervia*** ▲.



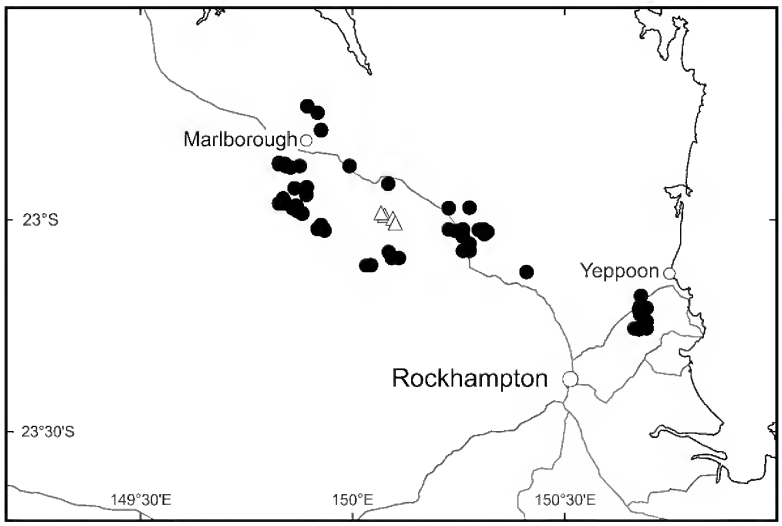
Map 4. Distribution of ***Pimelea curviflora*** var. ***divergens*** ● (Queensland records only), ***P. gigandra*** ▲, ***P. rupestris*** ■, ***P. umbratica*** ✸.



Map 5. Distribution of ***Pimelea curviflora*** var. ***gracilis*** ✸ (Queensland records only), ***P. elongata*** ● (Queensland records only), ***P. mollis*** ■, ***P. simplex*** subsp. ***simplex*** ●, ***P. strigosa*** ▲.



Map 6. Distribution of ***Pimelea fugiens*** □, ***P. leptostachya*** ▲, ***P. simplex*** subsp. ***continua*** ● (Queensland records only).



Map 7. Distribution of ***Pimelea leptospermoides*** subsp. ***bowmanii*** △, *P.* ***leptospermoides*** subsp. ***leptospermoides*** ●.

Fimbristylis buchanensis R.Booth & P.R.Sharpe and *F. triloba* R.Booth & P.R.Sharpe (Cyperaceae), two new species from Queensland

R. Booth & P.R. Sharpe*

Summary

Booth, R. & Sharpe P.R. (2017). *Fimbristylis buchanensis* R.Booth & P.R.Sharpe and *F. triloba* R.Booth & P.R.Sharpe (Cyperaceae), two new species from Queensland. ***Austrobaileya* 10(1): 47–58.** Two new species of Fimbristylis Vahl, are described, *viz. Fimbristylis buchananensis* R.Booth & P.R.Sharpe, *F. triloba* R.Booth & P.R.Sharpe. The new taxa are illustrated and notes are provided on their distribution and habitat. An identification key to Queensland species of *Fimbristylis* is provided.

Key Words: Cyperaceae, *Fimbristylis*, *Fimbristylis buchananensis*, *Fimbristylis triloba*, Australia flora, Northern Territory flora, Queensland flora, taxonomy, identification key

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Introduction

The genus *Fimbristylis* Vahl has *c.* 300 species distributed in tropical and subtropical regions, with some extending into warmer parts of temperate regions. The species mainly occur in SE Asia, Malesia and northeastern Australia (Goetghebeur 1998). Unlike *Cyperus* L., few species are pantropical, with the number of endemic species being relatively high (Kern 1974). S.T. Blake, who contributed much to our understanding of the Queensland species, suggested that the genus was represented by *c.* eighty species in Australia (Blake 1940), with Latz (1990) including 128 species in his draft key to Australian species of *Fimbristylis*.

Vahl (1805) segregated *Fimbristylis* from *Scirpus* Vahl, including in the former only those species with spirally arranged glumes and a biconvex or trigonous nut, and a basally expanded, usually ciliate, 2 or 3 branched style. He placed those with sub-distichous basal glumes and a trigonous style base that is persistent on the fruit in the genus *Abildgaardia* Vahl. The genus *Bulbostylis* Kunth was erected by Kunth (1837) for species considered intermediate between *Isolepis* R.Br. and *Fimbristylis*. Subsequent authors have variously recognized *Fimbristylis*, *Bulbostylis* and *Abildgaardia* as three separate genera, or treated them as either two genera, or even one genus on the basis of morphological similarities (Bruhl 1995; Muasya *et al.* 2009). Ghamkhar *et al.* (2007) in a molecular analysis argued for the retention of *Abildgaardia* (except *A. vaginata* R.Br.) distinct from *Bulbostylis* and *Fimbristylis*. For convenience, in the key provided we have included the genus *Abildgaardia* alongside *Fimbristylis*.

Sharpe (1986) provided manuscript names and preliminary descriptions for the two species here formally described and named and included them in a DELTA key (Jessup *et al.* 2005 onwards). Due to the extensive field work undertaken in recent years by staff of the Queensland Herbarium, particularly in north Queensland, more *Fimbristylis* material has become available for study. Critical examination of these collections by the first author has now enabled these new species to be formally described and named.

Accepted for publication 28 June 2017

Materials and methods

All herbarium specimens of *Fimbristylis* held at BRI have been examined. Measurements were made from dried material. A common abbreviation used in the text and specimen citation is NP (National Park).

Taxonomy

Fimbristylis buchananensis R.Booth & P.R.Sharpe **sp. nov.** Similar to *Fimbristylis cymosa* R.Br. but differs in the longer (> 2.8 mm) glumes versus < 2.25 mm long glumes; the longer (5–13 mm long) oblong spikelets versus shorter (3–6 mm long) ovate spikelets and the narrower (0.3–0.6 mm wide) lamina versus 1 to 3 mm wide. **Typus:** Queensland. Mitchell District: The Lake, east of Aramac, 11 March 1998, *R.J. Fensham 3479* (holo: BRI, iso: NSW).

Fimbristylis sp. Lake Buchanan (V.J.Neldner +3362); Booth (2014).

Slender perennial with a short rhizome, 25–65 cm tall. Culms tufted, erect, trigonous, smooth, or striate, 0.8–1.5 mm wide. Sheaths yellowish-brown to dark brown. Leaves all basal, less than half length of inflorescence culm. Lamina erect, flat or canaliculate, straight, 0.3–0.6 mm wide, ciliate or scabrid on the margins. Ligule membranous. Involucral bracts 1–4; longer or shorter than the inflorescence, erect, or oblique. Inflorescence simple or once compound, panicle-like, 2–6-branched, 3–6 cm long. Spikes 1–10, sessile, or pedunculated, ovoid, spreading, or erect, dense, 5–13 mm long, 1.5–15 mm wide. Spikelets erect, ovoid, oblong, oblong-ovoid or cylindrical, open or dense, acute, 5–13 mm long, 1.5–2.5 mm wide, 10–26-flowered, pedicellate or sessile, straight, 1–14 per cluster, stramineous or pale brown to brown. Stamens 3; anthers linear, 1.2–1.5 mm long, connective setulose. Rachis angular but not broadly winged. Glumes spirally arranged, membranous, ovate, narrowly ovate or ovate-lanceolate, 2.8–3.4 mm long, 1.2–1.5 mm wide, apex acuminate, with a straight mucro, surface glabrous, keeled with an arcuate keel, 2-nerved, sides nerveless, margin glabrous. Rachilla persistent on rachis after glumes and achenes have fallen off, winged. Style deciduous, longer than stigmas, longer than achene, fimbriate, flat, dilated at the base. Stigmas three. Achene obovoid, trigonous, margins obtuse, 0.9–1.1 mm long, 0.5–0.7 mm wide, with 3 longitudinal ribs, surface with fine, longitudinally linear cells in many vertical rows, tuberculate with age, apex apiculate or truncate, base stipitate. **Fig. 1.**

***Additional specimens examined*: Queensland.** Burke District: Near the source of Poison Creek, *c.* 90 miles [150 km] N of Hughenden, Apr 1935, *Blake 8561* (BRI). South Kennedy District: W of Lake Constant, 2 km W of Lake Buchanan, May 1991, *Neldner & Thompson 3362* (BRI); Lake Constant foreshore, 1.8 km W of Lake Buchanan, May 1991, *Neldner & Thompson 3356* (BRI); W edge of Lake Buchanan, Yarrowmere Station, Mar 1998, *Kemp 3380H* (BRI); 21 km S of Yarrowmere Homestead, on eastern side of lake, Mar 2002, *Thompson BUC2197* (BRI); Lake Buchanan, Mar 1998, *Thompson BUC2128* (BRI).

***Distribution and habitat*:** *Fimbristylis buchananensis* is endemic to Queensland and has been found from *c.* 90 km north of Hughenden to as far south as Aramac, with most collections around Lake Buchanan and Lake Constant (**Map 1**). Most collections have been around lake foreshores, on old sand dunes or remnant lake beds.

***Affinities*:** *Fimbristylis buchananensis* has some similarities to more robust forms of *F. cymosa* which it differs from most obviously in the glume length, in the longer, oblong spikelets and the narrower lamina. The plants also grow in different habitats, *F. cymosa* being mostly coastal with saline influence, while *F. buchananensis* occurs in inland areas, mainly in old dune systems.

***Conservation status*: Least Concern**.

***Etymology*:** Named after Lake Buchanan south west of Charters Towers where the species is commonly found.

Fimbristylis triloba R.Booth & P.R.Sharpe **sp. nov.** Similar to *Fimbrisytlis rara* R.Br. but differs in the larger achene (1.2–1.4 mm long versus 0.8–1.1 mm); longer glumes (> 3.5 mm, versus < 2.5 mm) with an acute apex (versus obtuse) and glandular markings (versus absent). **Typus:** Queensland. Burke District: Esmeralda, SSE of Croydon. 19 July

Fig. 1. ***Fimbristylis buchananensis.*** A. base of plant ×0.6. B. inflorescence ×0.8. C. spikelet ×8. D. spikelet with rhachilla ×8. E. achene with filaments, style and stigmas ×16. F. achene with style and stigmas ×32. A & B from *Kemp 338OH* (BRI); C–F from *Neldner & Thompson 3362* (BRI). Del. W. Smith.

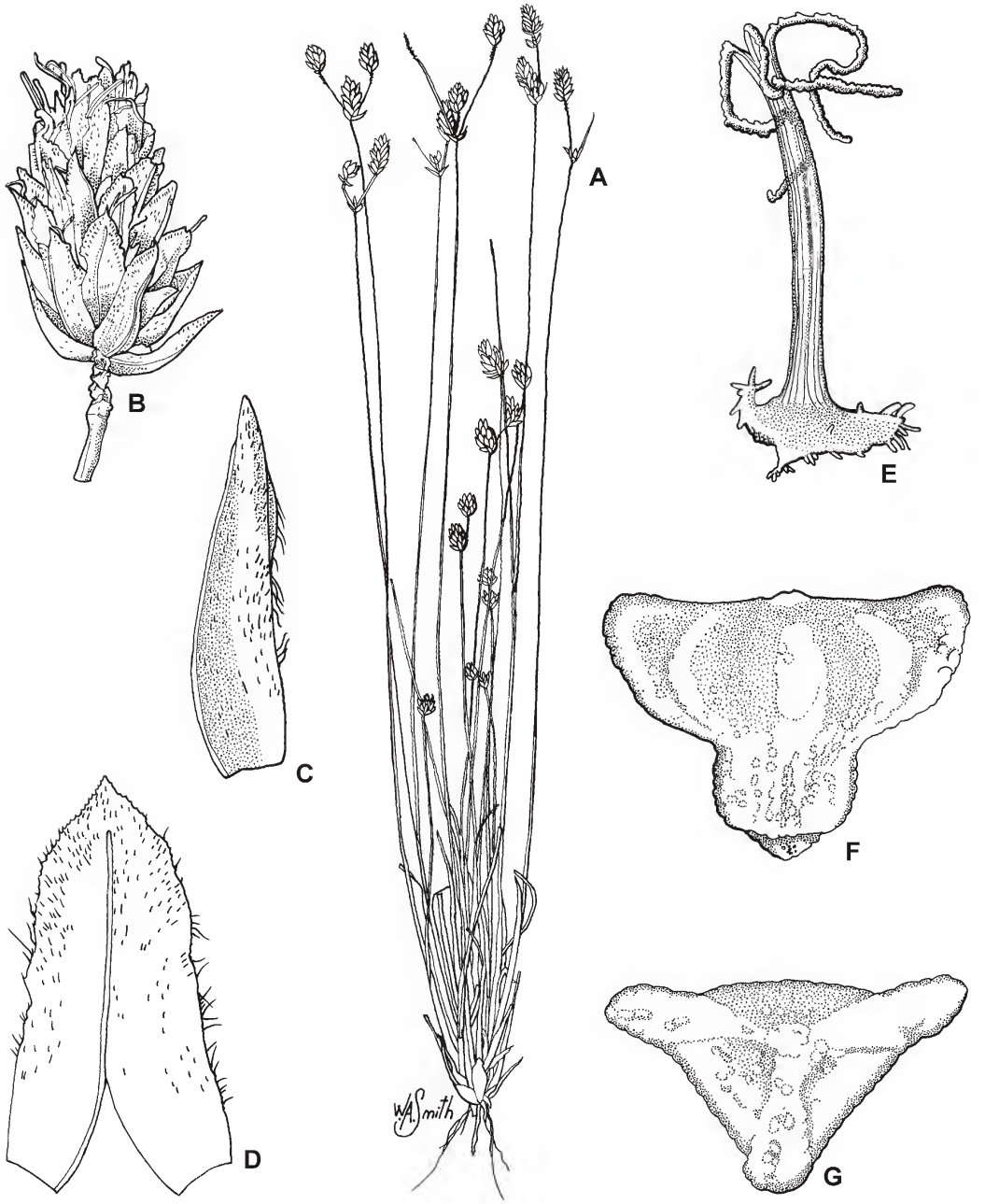

Fig. 2. ***Fimbristylis triloba.*** A. whole plant ×0.5. B. spikelet ×4. C. glume (side view) ×12. D. glume (dorsal view) showing brown flecks on the surface ×12. E. stigmas and style ×32. F. achene (lateral view) ×32. G. achene from above ×32. All from *Blake 19640* (BRI). Del. W. Smith.

1954, *S.T. Blake 19640* (holo: BRI; iso: NSW, NT, PERTH).

Fimbristylis sp. (Esmeralda Gorge S.T. Blake 19640); Booth (2014).

Slender annual with fibrous roots, 12–50 cm tall. Culms tufted, trigonous, striate, scabrous, 0.5–1.2 mm wide. Leaves all basal, shorter than the stem. Lamina flat, straight, 1–1.5 mm wide, glabrous, margins in lower part hyaline, spotted with brown flecks. Involucral bracts 2–4, glume like, shorter than the spikelet, smooth. Inflorescence simple or once compound, open, consisting of 1–5 primary rays obliquely erect. Spikelets solitary, ovoid or almost globular, obtuse, many-flowered, erect, 5–12 mm long, 3–6 mm wide, pale brown to brown. Stamens 3; anthers linear, connective smooth, 1.8–2 mm long. Glumes spirally arranged, ovate, or broadly ovate, 3.5–5 mm long, light brown to brown with red-brown glandular markings, surface glabrous, apex acute, margin ciliate, keeled without nerves; rachilla persistent on rachis after glumes and achenes have fallen off, narrowly winged. Style as long as stigmas, triquetrous, glabrous, base prominently enlarged, triangular, surface with short, turgid hairs. Stigmas three. Achene broadly obovoid or obpyriform, trigonous, apex truncate, base rather prominently stipitate, lobes at the distal end decurrent on achene angles; 1.2–1.4 mm long, 0.8–1 mm wide, smooth, epidermal cells isodiametric. **Fig. 2.**

***Additional specimens examined*:** Queensland. Cook District: Adjacent to Pelican Creek, Staaten River NP, Apr 2004, *Fox 3113* (BRI); S of Highbury Homestead, Staaten River NP. Apr 2004, *Fox 3112* (BRI); 153 km NE of Normanton, Jul 2001, *Thompson NOR181* (BRI).

***Distribution and habitat*:** *Fimbristylis triloba* is endemic to Queensland and has been collected as far north as Staaten River NP and as far south as Esmeralda Station (**Map 1**). It has been recorded from seepage areas, mainly in *Melaleuca* dominated woodlands on sand.

***Affinities*:** *Fimbristylis triloba* is similar to *F. rara*, but easily distinguishable by the length of the glumes that are reddish-brown spotted and the glume apex shape. The inflorescence of *F. triloba* resembles that of *F. helicophylla* Rye, R.L.Barrett & M.D.Barrett which is restricted to the Kimberley in Western Australia. It differs in the distinctive obpyriform achene of *F. triloba*, compared to ovate in *F. helicophylla*; also the leaves of *F. helicophylla* are broad, fleshy, twisted and up to 3.6 mm wide, versus straight and up to 1.5 mm wide in *F. triloba.*

Conservation status: Least Concern. Present in Staaten River NP.

***Etymology*:** Named for the three lobes at the distal end of the angles of the achenes.

Key to Queensland species of *Fimbristylis* and *Abildgaardia*

1 Spikelets solitary on each stem **2**
1. Spikelets more than one on each stem **35**

2 Stigmas 2 . . . . . **3**
2. Stigmas 3 . . . . . **14**

3 Achene with transverse, wavy ridges **4**
3. Achene longitudinally striate, finely reticulate, smooth or tuberculate **8**

4 Spikelet oblique or distinctly nodding; style broad, *c.* 0.5 mm wide . . . . . **F. nutans**
4. Spikelet erect; style narrow, < 0.4 mm wide 5

5 Glumes 1.5–1.8 mm long . . . . . **F. nuda**
5. Glumes > 2 mm long **6**

6 Upper part of top most glumes with short fine hairs on the surface or margin . . . . . **F. punctata**
6. Upper part of glumes glabrous 7

7 Lowest glume broadly obtuse, much shorter than fertile glumes; mature achene broadly obovate to sub-orbicular, usually > 1.4 mm long, often dark brown with a white annulus at the base . . . . . **F. acuminata**
7. Lowest glume obtuse or acute, only slightly shorter than the fertile glume; mature achene obovate, < 1.4 mm long, usually white or straw coloured without a white annulus at the base . . . . . **F. acicularis**

8 Spikelet 1–3 mm wide **9**
8. Spikelet > 3 mm wide **12**

9 Spikelet cylindrical 6–15 mm long; leaves mostly reduced to sheathing scales; achene < 0.5 mm long, finely tuberculate; upper flowers female only . . . . . **F. denudata**
9. Spikelet fusiform or ovoid-elliptical; leaves developed; achene > 0.5 mm long, not tuberculate **10**

10 Achene nearly terete, obovoid-globose, obscurely 2-angled, dark brown; glumes 1–1.5 mm long . . . . . **F. distincta**
10. Achene biconvex, acutely angled, grey or white; glumes 2–3 mm long **11**

11 Spikelets 2–3 mm wide; glumes muticous; achene 0.8–1.2 mm long, grey . . . . . **F. polytrichoides**
11. Spikelets < 1.6 mm wide; glumes with > 0.3 mm long mucro; achene 0.6–0.7 mm long, white to pale brown . . . . . **F. adjuncta**

12 Achene oblong-cylindrical, ribbed longitudinally with a conspicuous gynophore 0.5–1 mm long; upper parts of the stem quadrangular . . . . . **F. tetragona**
12. Achene biconvex, obovoid with gynophore < 0.5 mm long; upper part of the stem terete or flattened **13**

13 Glumes 4–6 mm long; base of stem bulbous . . . . . **F. tristachya**
13. Glumes 2.5–3 mm long; base of stem not bulbous . . . . . **F. schoenoides**

14 Spikelet oblique or at right angles to stem **15**
14. Spikelet erect **16**

15 Glume apex with two terminal wings with red, linear flecks; glabrous . . . . **F. costiglumis**
15. Glume apex rounded; finely ciliate . . . . . **F. densa**

16 Fertile glumes > 8.5 mm long **17**
16. Fertile glumes < 8 mm long **18**

17 Plants with well-developed leaves; glumes 8.5–10.2 mm, distinctly awned; achene 2–2.6 mm long, including an abruptly constricted *c.* 1 mm long stipe . . . . . **F. odontocarpa**
17. Plants nearly leafless; glumes 10–15 mm long, acute; achene > 2.6 mm long, stipe acuminate and not constricted . . . . . **F. squarrulosa**

18 Achene long cylindrical with a conspicuous gynophore; upper part of the stem quadrangular . . . . . **F. tetragona**
18. Achene obovate, pyriform or winged, no conspicuous gynophore; upper part of the stem terete or flattened **19**

19 Achene with transversely wavy ridges **20**
19. Achene longitudinally striate, finely reticulate, smooth or tuberculate **21**

20 Spikelets 6–8 mm wide; glumes glabrous . . . . . **F. carolinii**
20. Spikelets 2–4 mm wide; glumes with minute hairs on the upper surface . . . . **F. punctata**

21 Leaves densely minutely hairy . . . . . **F. leucocolea**
21. Leaves glabrous **22**

22 Achene flattened with acute edges, these with distinct wings *c.* 0.5 mm wide **23**
22. Achene not flattened, may be somewhat compressed, with no wings **24**

23 Basal glume less than ½ as long as fertile glumes, glumes 5–7 mm long, distichous; wings on the achene solid . . . . . **F. pachyptera**
23. Basal glumes all of a similar size, glumes 4–6 mm long, spirally arranged; wings on the achene ciliate or membranous . . . . . **F. pterigosperma**

24 Spikelet < 1.5 mm wide; glumes usually < 10 per spikelet . . . . . **F. pauciflora**
24. Spikelet > 1.5 mm wide, glumes usually > 10 per spikelet **25**

25 Glumes entirely glabrous **26**
25. Glumes ciliate on the margins or with hairs on at least parts of the surface **32**

26 Keel at the base of the glume at least 0.4 mm wide, broadly rounded **27**
26. Keel of glume < 0.3 mm wide, angular, if rounded then narrowly so **28**

27 Achene coarsely tuberculate, pale straw to grey brown; style with broad, membranous margins for the entire length; glumes white to straw coloured; clay soils . . . . . **Abildgaardia ovata**
27. Achene smooth or slightly tuberculate, greyish to dark grey/black; style fimbriate, with no membranous margins; glumes, light brown to brown; in rocky situations often with a sandstone influence . . . . . **F. macrantha**

28 Glumes at least 5 mm long; distichous, at least in young spikelets, the rachillas sometimes becoming twisted with age; spikelets strongly laterally compressed, similar to those in *Cyperus* **29**
28. Glumes up to 5 mm long, spirally arranged, not strongly laterally compressed **30**

29 Achene densely tuberculate, 2–2.8 mm long . . . . . **F. oxystachya**
29. Achene reticulated often with a few small tubercules, 1.4–1.8 mm long . . . . . **Abildgaardia vaginata**

30 Spikelet < 2.4 mm wide; glumes < 2.5 mm long . . . . . **F. modesta**
30. Spikelet at least 2.5 mm wide; glumes > 2.5 mm long **31**

31 Glumes oblong acute, lowest (empty) glume more than half as long as the spikelet . . . . . **F. dictyocolea**
31. Glumes broadly obtuse to rounded, lowest glume half or less than half of the length of the spikelet . . . . . **F. simplex**

32 Glumes < 3 mm long **33**
32. Glumes > 4 mm long **34**

33 Achene obpyriform, constricted just below the middle; apex of the spikelets acute . . . . . **F. trigastrocarya**
33. Achene broadly obovoid to obovoid; apex of spikelets obtuse . . . . . **F. sphaerocephala**

34 Spikelets 5–10 mm wide; glumes 5–10 mm long . . . . . **F. recta**
34. Spikelets 2.5–4 mm wide; glumes < 5 mm long . . . . . **F. cardiocarpa**

35 Spikelets more than 1 on each stem but not clustered **36**
35. Spikelets capitate or somewhat clustered **85**

36 Stigmas 2 . . . . . **37**
36. Stigmas 3 . . . . . **58**

37 Achene < 1 mm long **38**
37. Achene > 1 mm long **48**

38 Spikelets, 1–4 (–6), cylindrical, only female flowers in upper part; leaves mostly reduced to sheathing scales . . . . . **F. denudata**
38. Spikelets numerous, ovoid-oblong, all flowers bisexual; leaves with lamina **39**

39 Achene < 0.5 mm long . . . . . **F. caespitosa**
39. Achene > 0.5 mm long **40**

40 Achene sub-cylindrical, oblong-linear in outline . . . . . **F. dipsacea**
40. Achene not as above **41**

41 Style base with numerous long hairs pendent over apex of the achene . . . . . **F. velata**
41. Style base without hairs pendent over achene **42**

42 Achene with 5–10 conspicuous longitudinal ribs on each face with numerous cross-bars, glistening white to stramineous, rarely brown **43**
42. Achene reticulate, smooth or tuberculate, not ribbed as above **45**

43 Upper part of the stem and the base of the involucral bracts with pilose hairs; style shorter than the achene . . . . . **F. depauperata**
43. Upper part of the stem and the base of the involucral bracts either glabrous or with only short hairs on the margins; style longer than the achene **44**

44 Stamens 2 or 3; glumes orbicular . . . . . **F. dichotoma (inland form)**[1]
44. Stamens 1; glumes elliptic . . . . . **F. bisumbellata**

45 Leaves and involucral bracts densely hairy; glumes acute, mucronulate . . . . **F. aestivalis**
45. Leaves and involucral bracts glabrous; glumes obtuse, muticous **46**

46 Glumes < 1.4 mm long . . . . . **F. stenostachya**
46. Glumes > 1.4 mm long **47**

47 Surface of the glumes pubescent . . . . . **F. pubisquama**
47. Surface of the glumes glabrous . . . . . **F. cymosa**

48 Glumes ciliolate on margins or with hairs on part of the surface **49**
48. Glumes entirely glabrous **51**

49 Glumes up to 2.5 mm long, pubescent over most of the surface . . . . . **F. pubisquama**
49. Glumes 2.8–4.5 mm long, pubescent mainly on the upper parts **50**

50 Glumes nearly as broad as long, style *c.* 0.4 mm wide; involucral bracts usually longer than the inflorescence; annual with long leaves . . . . . **F. sieberiana**
50. Glumes considerably longer than broad, style *c.* 0.25 mm wide; involucral bracts shorter than the inflorescence; perennial with short leaves . . . . . **F. ferruginea**

[1] *Fimbristylis dichotoma* is a variable species with many forms. Two of these forms are separated in the above key: *Fimbristylis* sp. (Elizabeth Springs R.J.Fensham 3743) which occurs in artesian springs, and *F. dichotoma* (inland form), a depauperate form that occurs in drier inland areas of Queensland. More study of this extremely variable species is required to determine whether these and other forms can be distinguished consistently.

51 Achene with 5–10 conspicuous longitudinal ribs on each face with numerous cross-bars, glistening, white to stramineous, rarely brown **52**
51. Achene smooth, finely reticulate or verrucose **54**

52 Upper part of the stem and the base of the involucral bracts with pilose hairs; style shorter than the achene . . . . . **F. depauperata**
52. Upper part of the stem and the base of the involucral bracts either glabrous or with only short hairs on the margins; style longer than the achene **53**

53 Spikelets uniform pale brown; glumes with the mid rib finishing in a broad mucro at least 0.2 mm long . . . . **F. sp. (Elizabeth Springs R.J.Fensham 3743)**[1]
53. Spikelets usually with darker brown patches; glume with a mucro < 0.2 mm long . . . . . **F. dichotoma**[1]

54 Inflorescence mainly consisting of a single spikelet, occasionally some with 2 or 3 . . . **55**
54. Inflorescence a panicle consisting of at least 4 spikelets **57**

55 Glumes 4–6 mm long; spikelets 4–5 mm wide; base of stem bulbous . . . . . **F. tristachya**
55. Glumes 2–3 mm long; spikelets 2–4 (–4.5) mm wide; base of stem not bulbous **56**

56 Spikelets 2–3 mm wide; glumes longer than they are broad . . . . . **F. polytrichoides**
56. Spikelets 3–4.5 mm wide; glumes as broad as they are long . . . . . **F. schoenoides**

57 Stem and leaves spongy, compressible . . . . . **F. dolera**
57. Plant with leaves reduced to short sheaths, stems not spongy . . . . . **F. blakei**

58 Glumes with long scabrid awns 1–1.5 mm long . . . . . **F. signata**
58. Glumes without long scabrid awns **59**

59 Style base with hairs pendent over a dark achene . . . . . **F. furva**
59. Style base not with the above combination **60**

60 Glumes folded obtusely around the nut, rounded, causing the glumes to be somewhat flattened at maturity, and spikelets more or less rounded in cross section **61**
60. Glumes folded acutely, not flattened, causing the spikelets to be angular or compressed in cross section **67**

61 Stems sharply 4 or 5 angled; glumes up to 1.5 mm long . . . . . **F. littoralis**
61. Stems 3-angled or terete; glumes > 1.5 mm long **62**

62 Glumes 3.5–5 mm long **63**
62. Glumes < 3 mm long **65**

63 Spikelets oblong, > 3.5 times longer than broad **64**
63. Spikelets broadly ovoid to almost globular < 2.5 times longer than broad . . . . . **F. triloba**

64 Glumes with distinct reddish-brown linear flecks on the surface . . . . . **F. lanceolata**
64. Glumes with no reddish-brown flecks . . . . . **F. insignis**

65 Plant with long stolons . . . . . **F. vagans**
65. Plant without stolons **66**

66 Plants with broad leaves up to 4.5 mm wide; rays on the inflorescence scabrous . . . . . **F. clavata**
66. Plant with narrow leaves up to 3 mm wide; rays glabrous . . . . . **F. rara**

67 Glume surface pubescent and/or margins with long hairs **68**
67. Glume surface and margins glabrous **71**

68 Glumes with a distinct, broad, whitish membranous margin **69**
68. Glumes with no membranous margin . . . . . **F. corynocarya**

69 Glumes distichously arranged, similar to *Cyperus* . . . . . **F. fimbristyloides**
69. Glumes distinctly spirally arranged **70**

70 Base of the involucral bracts pubescent; top of stems scabrous . . . . . **F. phaeoleuca**
70. Base of the involucral bracts glabrous; stems glabrous . . . . . **F. cymosa**

71 Plant with long stolons . . . . . **F. vagans**
71. Plant without stolons **72**

72 Leaves reduced to loose sheaths; inflorescence consisting of 1 sessile spikelet plus 1–3 spikelets on branches to 2 cm long . . . . . **Abildgaardia vaginata**
72. Plants with long leaves, inflorescence not as above **73**

73 Stems sharply 4 or 5-angled **74**
73. Stems 3 angled, terete or compressed, may be ribbed **77**

74 Glumes 3–5 mm long . . . . . **F. eragrostis**
74. Glumes 1–1.5 mm long **75**

75 Glume mucro with a few scabrous hairs . . . . . **F. elegans**
75. Glume mucro absent or glabrous **76**

76 Spikelets ovoid to narrowly ovoid; leaves with a prominent mid-rib and rib like margins; rachillas with ragged scale like wings after the nuts have fallen . . . . . **F. quinquangularis**
76. Spikelets mostly globose; leaves with thinly grooved margins, no mid-nerve; rachillas not winged . . . . . **F. littoralis**

77 Glume with an obvious broad, whitish membranous margin **78**
77. Glume margin with no obvious membranous margin **81**

78 Glume apex obtuse or muticous . . . . . **F. cymosa**
78. Glume apex with a mucro or at least acute **79**

79 Glumes < 2 mm long . . . . . **F. elegans**
79. Glumes > 2 mm long **80**

80 Glume mucro *c.* 0.4 mm long; spikelets distinctly angular in cross section; . . . . . **F. subaristata**
80. Glume mucro *c.* 0.2 mm long or less; spikelets obscurely angular in cross section; . . . . . **F. micans**

81 Stems in upper part strongly flattened and winged . . . . . **F. complanata**
81. Stems not flattened, may be slightly compressed, but not winged **82**

82 Glumes with distinctly raised reddish brown flecks . . . . . **F. cinnamometorum**
82. Glumes with no reddish brown flecks **83**

83 Glumes > 2.5 mm long . . . . . **F. buchananensis**
83. Glumes < 2.5 mm long **84**

84 Spikelets not more than 1.2 mm wide . . . . . **F. microcarya**
84. Spikelets > 1.3 mm wide . . . . . **F. cymosa**

85 Stem in upper part strongly flattened and winged; ligule ciliate . . . . . **F. complanata**
85. Stems 3 sided; ligule membranous or absent **86**

86 Style with a basal whorl of hairs covering the apex of a dark achene . . . . . **F. furva**
86. Style not as above **87**

87 Achene with 5–10 conspicuous longitudinal ribs on either face with numerous cross-bars, glistening white to stramineous, rarely brown . . . . **F. dichotoma**[1]
87. Achene smooth, with 3 longitudinal ribs, finely reticulate, verrucose or tuberculate **88**

88 Glumes > 4 mm long . . . . . **F. neilsonii**
88. Glumes < 4 mm long **89**

89 Involucral bracts and surface of upper glumes pubescent . . . . . **F. sericea**
89. Involucral bracts and upper glumes not pubescent, margins of the glumes may be slightly ciliate **90**

90 Inflorescence a compact head of spikelets . . . . . **F. schultzii**
90. Inflorescence a panicle **91**

91 Glumes 1.3–2.5 mm long . . . . . **F. cymosa**
91. Glumes 2.8–3.4 mm long . . . . . **F. buchananensis**

Acknowledgements

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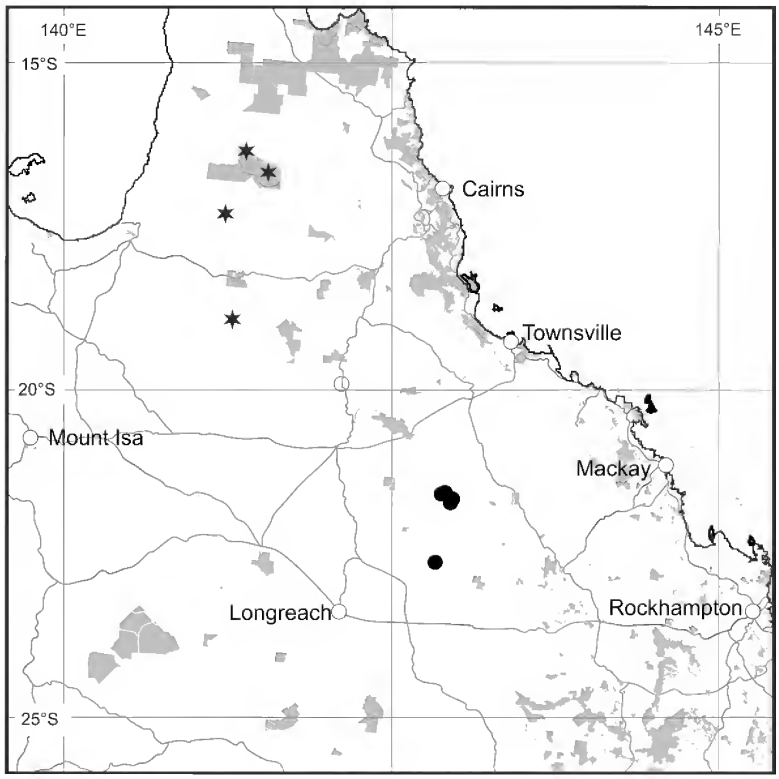

Map 1. Distribution of *Fimbristylis triloba* ✱ and *F. buchananensis* ●. Grey shaded areas are conservation reserves and National Parks.

Lomandra decomposita (R.Br.) Jian Wang ter & A.R.Bean (Laxmanniaceae), a new species for Queensland

Jian Wang & A.R. Bean

Summary

J. Wang & A.R. Bean (2017). *Lomandra decomposita* (R.Br.) Jian Wang ter & A.R.Bean (Laxmanniaceae), a new combination for a north Queensland species. ***Austrobaileya* 10(1): 59–63**. *Lomandra decomposita* (R.Br.) Jian Wang ter & A.R.Bean is described, illustrated and differentiated from similar and related taxa. The known distribution of the newly reinstated species is from Charters Towers to the islands of the Torres Strait in Queensland. A conservation status of Least Concern is proposed.

Key Words: Laxmanniaceae, *Lomandra*, *Lomandra decomposita*, *Lomandra multiflora*, *Lomandra multiflora* subsp. *multiflora*, Australia flora, Queensland flora, taxonomy, new combination, conservation status

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Introduction

Lomandra Labill. is a genus of four sections with 54 species, all occurring in Australia, with two species extending to New Guinea and one species in New Caledonia (Lee & Macfarlane 1986; Macfarlane & Conran 2014). The genus was revised by Lee (1966). Currently, there are 17 recognised species in Queensland, as well as three non-autonymic subspecies (Wang 2015). *Lomandra multiflora* (R.Br.) Britten belongs to the Section *Lomandra*, Series *Lomandra* (Lee & Macfarlane 1984). It includes two subspecies, *L. multiflora* (R.Br.) Britten subsp. *multiflora* and *L. multiflora* subsp. *dura* (F.Muell.) T.Macfarlane, the former throughout eastern Queensland, New South Wales and Victoria and parts of the Northern Territory and the latter in South Australia only. Examination of herbarium material has revealed the existence of a distinctive species that was included within *Lomandra multiflora* (R.Br.) Britten subsp. *multiflora* by Lee & Macfarlane (1986). The name *Xerotes decomposita* R.Br. is applicable to this species and the new combination is made here.

Materials and methods

This study is based on morphological examination of *Lomandra* herbarium material, especially specimens identified as *Lomandra multiflora* subsp. *multiflora*, as well as undetermined *Lomandra* species at BRI and specimens received on loan from MEL, NSW and DNA. Images of type specimens at BM were viewed online.

All measurements are based on dried material, except the dimensions of flowers which are based on material reconstituted with boiling water. National Park is abbreviated to NP in the text and specimen citations.

Taxonomy

Lomandra decomposita (R.Br.) Jian Wang ter & A.R.Bean, **comb. nov.**; *Xerotes decomposita* R.Br., *Prodr.* 262 (1810); *Xerotes multiflora* var. *decomposita* (R.Br.) Domin, *Biblioth. Bot.* 85: 526 (1915). **Type:** Queensland. Cook District: Endeavour River, June/August 1770, *J. Banks & D. Solander s.n.* (lecto: BRI [AQ49624] [here designated]; isolecto: BM [000939335, 000939336]).

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Xerotes media R.Br., *Prodr.* 262 (1810); *Xerotes multiflora* var. *media* (R.Br.) Domin, *Biblioth. Bot.* 85: 526 (1915). **Type:** Queensland. Cook District: Endeavour River, June/August 1770, *J. Banks & D. Solander s.n.* (syn: BM).

Xerotes savannorum Domin, *Biblioth. Bot.* 85: 526 (1915). **Type:** Queensland. North Kennedy District: near Pentland, March 1910, *K. Domin 2385, 2386, 2387* (syn: PR, *n.v.*).

Plants more or less robust, forming tussocks from condensed ascending rhizomes. Each tussock comprising 1 to 5 tufts. Leaves firm, upright to slightly curved. Leaf sheath margins at first membranous or cartilaginous, fraying into short to long strips or fibres up to 8 cm long, white or pale to dark brown. Leaf blades usually glaucous, smooth to scabrid, slightly convex on the abaxial side or inrolled, 40–80 cm long, 2.3–4.5(–6.5) mm wide, with up to 30 parallel veins on the adaxial side and up to 28 parallel veins on the abaxial side; apex broadly rounded to obtuse without teeth; the margins slightly thickened, smooth to minutely serrulate. Male inflorescence 1 per tuft, paniculate, usually shorter than longest leaf; the peduncle flattened, smooth to verrucate, 10–34(–39) cm long, usually 0.25–0.3 cm broad. pale yellow; the primary rachis 4-angled, smooth to verrucate, 9–33(–40) cm long, bearing numerous branches and flower clusters; branches and flower clusters appearing whorled or opposite at nodes; inflorescence branches usually 4-angled, smooth to verrucate, 4–15 cm long; flower clusters 3–7 cm apart on the primary rachis, 1–3 cm apart on the secondary rachis (first branch), 0.5–1.5 cm apart on the tertiary rachis (second branch); inflorescences occasionally developing a quaternary rachis (third branch) 0.2–0.3 cm long. Cluster bracts usually 3–7, long- to short-deltoid, up to 1.5 cm long, *c.* 2 mm wide at the widest point, with 1–6 obvious veins, largest at the basal node of primary rachis, shorter and narrower upwards along primary rachis as well as on secondary and tertiary rachis. Flowers in groups of 4–15(–25) in each cluster, all of similar age within each cluster; bracteoles 3, cucullate, *c.* 0.5 mm long and 0.4 mm wide, membranous, completely encircling the pedicel. Flowers pedicellate, the pedicels slender, terete, 1.5–2.5(–3.5) mm long, 0.1–0.2 mm wide, grey to dark grey, erect to spreading. Flower buds globular, green, at anthesis becoming short campanulate, creamy-yellow to yellow. Perianth segments 6, with distinct outer and inner whorls; outer tepals 3, broadly elliptical, thin, free, uniform in size and texture, 1–1.1 mm long, 0.7–0.8 mm wide, pale yellow; inner tepals 3, elliptical, free except on lower 1/4–1/3, uniform in size and texture, 1.1–1.2 mm long, 0.8–0.9 mm wide, mostly creamy yellow except for brighter yellow in the middle of outer surface. Stamens 6, adnate basally to the inner tepals, the filament often connate throughout its length to the inner tepals; anthers all similar, 0.3–0.4 mm long, 0.2–0.3 mm wide, creamy yellow to bright yellow; anthers of inner tepals slightly more distal than the antetepalous anthers. Pistillode poorly formed, 0.1–0.2 mm long, pale yellow. Female inflorescences 1–3 per plant, a spike or usually a 1-branched panicle with numerous flower clusters, rachis and scape elongating with age; scape 4–26 cm long, 0.1–0.2 cm wide, flattened, smooth to verrucate; rachis often angled, verrucate; branches and flower clusters appearing whorled or opposite at nodes; the primary rachis 3–15 cm long, the secondary rachis usually 1–2 cm long. Cluster bracts usually 3–7, with 1–3 obvious veins, deltoid, up to 1.3 cm long, 1.5–2 mm wide at the base, largest at the basal node of primary rachis, shorter and narrower distally. Flowers in group of 3–9(–20), each subtended by 3–6 bracteoles, *c.* 2 mm long and 3 mm wide, membranous, completely encircling the flower base, sessile or shortly pedicellate, the pedicels *c.* 0.5 mm long and 0.5 mm wide, similar ages within each cluster; outer 3 tepals broadly ovate, *c.* 4 mm long and 1.8 mm wide, adnate at the base; inner 3 tepals ovate, *c.* 3 mm long and 1.2 mm wide, adnate near base. Staminodes 3(–6), whitish-transparent, with well-developed filaments and vestigial anthers, inserted on basal part of tepal. Pistil conspicuous, the ovary obovoid, 1.1–1.3 mm long, 0.7–1 mm diameter; styles stout, fused, with 3 robust out-curved stigmatic lobes; ovary with 3 locules; ovules 1 per loculus.

Fig. 1. ***Lomandra decomposita***. A. habit of male plant with flowering inflorescence ×0.3. B. habit of female plant with fruiting inflorescences ×0.3. C. top section of a leaf ×2. D. transection view of a leaf ×8. E. pedicellate male flower with bracts ×12. F. male flower spread open ×16. G. sessile female flower and its bracts ×8. H–J. sepals of the female flower ×8. K–M. petals of the female flower ×8. N. pistil ×8. O. opened fruit with seed ×6. A, F from *Johnson 4984* (BRI); B, O from *Clarkson 180* (BRI); C & D from *Kanis 2046* (BRI); E from *Forster PIF32574 & McDonald* (BRI); G–N from *McDonald 1652 & Batianoff* (BRI). Del. W. Smith.

Fruiting peduncle usually 10–25 cm long, 0.2–0.25 cm wide. Capsule 7.5–8 mm long, 5–6 mm diameter with 3 transverse wrinkled carpels at maturity; carpels dark grey outside, pale yellow inside; the carpel margins slightly ridged; the hardened perianth persistent, 3–3.5 mm long, 2–2.5 mm wide; the hardened bracts occasionally persistent, *c.* 1.5 mm long, 0.6–0.8 mm wide. Seeds 1 per locule, ovoid, 3.6–5.5 mm long, 2–3 mm wide, 2-angled on inner face, rounded on outer face, smooth to rough or slightly wrinkled, translucent in appearance, light brown to brown. **Fig. 1.**

***Additional selected specimens examined*: Queensland.** Cook District: Nagir (Mt Ernest) Island, Apr 1997, *Waterhouse BMW4337* (BRI, DNA); Prince of Wales Island, May 1906, *Tate s.n.* (BRI [AQ118336]);W of Bamaga, *c.* 27 km SW of Cape York, Oct 1965, *Smith 12489* (BRI); 28.9 km S of New Road turnoff, off Telegraph Line, Mar 1992, *Johnson 5081* (BRI); 27.2 km SE of Heathlands, Feb 1992, *Johnson 4984* (BRI); E of 'Bramwell' Homestead, on Olive River, Cape York Peninsula, Aug 1978, *Kanis 2046* (BRI, L); Olive River Environmental Reserve, 0.5 km W by road of 'Bromley' Homestead, Cape York Peninsula, Jun 2007, *Forster PIF32574 & McDonald* (BRI); 1 km N of Maloney's Springs, Jun 1989, *Forster PIF5294* (BRI); Portland Roads, Aylen Hills, May 1948, *Brass 18939* (BRI); Chilli Beach to Cape Weymouth Road, Jul 2003, *Sankowsky 2078 & Sankowsky* (BRI); Portlands Roads Road, 2 km E of Brown Creek, Jun 2004, *Gray 8928* (BRI, CANB), *8930* (BRI, CANB); Above cascades on Coen River near Coen, Nov 1980, *Morton AM789* (BRI); N side of Nesbit River, Silver Plains, Jun 1998, *Forster PIF22995 et al.* (BRI, CNS); Stanley Island, Jun 1991, *Godwin C3530* (BRI); 65 km SE of Coen Monitoring site 2 in Balclutha Creek Natural Refuge, Jun 2011, *Thompson SLT1105 & SLT1106* (BRI); Cooktown, May 1968, *San & Clifford s.n.* (BRI [AQ252808]); Endeavour River, in 1878, *Persieh 225* (MEL); *ibid.*, in 1883, *Persieh 838* (MEL); *ibid.*, *s.dat.*, *Persieh 967* (MEL); *ibid*, in 1885, *Persieh 406* (MEL); Mt Saunders, Mar 1984, *Scarth-Johnson 1478A* (BRI); 1 km W of Airport, Cooktown, Apr 1975, *McDonald 1652 & Batianoff* (BRI); Pannikin Springs area, Blackdown Station, May 1999, *Forster PIF24406 & Booth* (BRI); Stannary Hills, 13 km S of Mutchilba, Portion 603, May 2006, *Forster PIF31623 & McDonald* (BRI); *c.* 14 km N of the Lynd Road junction on the road to Hughenden, May 1975, *Clarkson 179 & 180* (BRI); 4.2 km NW of Margaret's Bore, 'Curlew Paddock', Lyndhurst Cattle Station, Mar 2002, *Kahler TH6736 & Appelman* (BRI). Burke District: 9.5 km SW of Clyde Park new homestead, 63 km NE of Hughenden, Mar 1993, *Thompson HUG228 & Henderson* (BRI), *Thompson HUG241 & Henderson* (BRI); 3 km SE of Clyde Park homestead, 74 km NE of Hughenden, Sep 1992, *Thompson HUG6 & Sharpe* (BRI). North Kennedy District: Minnamoolka Station, *c.* 35 km S of Mt Garnet, Apr 1991, *Batianoff MM9104023 & Franks* (BOL, BRI, CANB, K, PRE); 25 km W of Pentland on Great Dividing Range (locally known as 'Burra Range'), Jul 1975, *Chapman 1326* (BRI, CANB); North Branch Creek, White Mountains NP, Apr 1992, *Bean 4312* (BRI).

***Distribution and habitat*:** *Lomandra decomposita* is endemic to north east Queensland where it is widespread on Cape York Peninsula extending south to White Mountains NP and east to near Charters Towers. It also occurs on some Torres Strait islands (**Map 1**). The species mainly grows in woodlands with *Corymbia clarksoniana* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson, *C. polycarpa* (F.Muell.) K.D.Hill & L.A.S.Johnson, *C. stockeri* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson, *Eucalyptus crebra* F.Muell., *E. leptophleba* F.Muell., *E. platyphylla* F.Muell., and open forests of *Corymbia nesophila* (Blakely) K.D.Hill & L.A.S.Johnson or *C. peltata* (Benth.) K.D.Hill & L.A.S.Johnson and *Eucalyptus tetrodonta* F.Muell., on sandstone and sandy soils. It has also been recorded in *Melaleuca viridiflora* Sol. ex Gaertn. forest, *Acacia shirleyi* Maiden and *Eucalyptus persistens* L.A.S.Johnson & K.D.Hill woodland on sandstone and deciduous vinethicket with metamorphic rocks.

***Phenology*:** Male flowering has been recorded every month except December. Female flowering was recorded only in April, August, October and November. Mature fruits were collected from February through to July.

***Typification*:** Original material of *Xerotes decomposita* is present at BM and BRI. The BRI specimen is a good quality flowering specimen. Therefore, it is chosen as the lectotype of *Lomandra decomposita*.

***Notes*:** *Lomandra decomposita* is related to the widespread *L. multiflora* subsp. *multiflora* of eastern Australia and *L. patens* A.Lee of central Australia. It differs from *L. multiflora* subsp. *multiflora* by the glaucous leaves, shorter pedicels in the male flowers, smaller and more rounded male flowers and the 6 anthers in the male flower aligned almost on the same level (**Fig. 1**). It differs from *L. patens* by the glaucous leaves, shorter inflorescence

bracts, smaller and more rounded male flowers with longer pedicels, the 6 anthers in the male flower aligned almost on the same level, the fewer branched female inflorescence and shorter persistent styles of the fruits.

***Conservation status*:** *Lomandra decomposita* can be a common species where it occurs. It is recorded from several National Parks and is not known to be at risk. Therefore, it is assessed as **Least Concern** using the IUCN (2012) criteria.

Acknowledgements

We are grateful to the Directors of DNA, MEL and NSW for providing specimens on loan and to Will Smith for producing the illustrations and distribution map.

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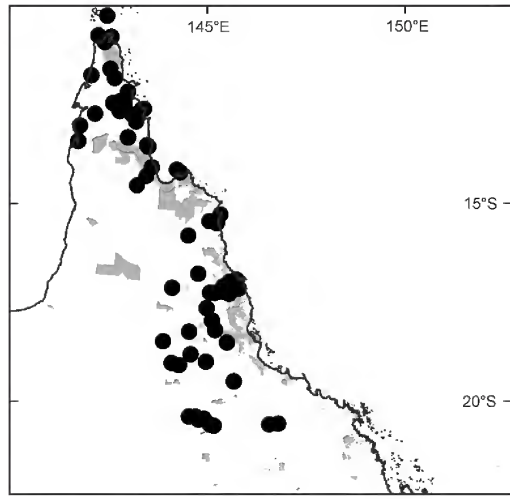

Map 1. Distribution of ***Lomandra decomposita***

SHORT COMMUNICATION

Polyalthia submontana subsp. *sessiliflorus* (Jessup) Jessup, a new combination in Australian Annonaceae

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Several genera of Annonaceae were recently reassessed on the basis of molecular and other evidence (Xue *et al.* 2012) and a number of new combinations were published including some for Australian taxa. The authors did not transfer or synonymise an Australian trinomial for a taxon that is currently recognised in Queensland. The necessary combination is therefore made below for this subspecies.

Polyalthia submontana (Jessup) B.Xue & R.M.K.Saunders subsp. **sessiliflorus** (Jessup) Jessup **comb. nov.**; *Haplostichanthus submontanus* Jessup subsp. *sessiliflorus* Jessup, *Fl. Australia* 2: 44, 449, fig. 9H (2007). **Type:** Queensland. Cook District: near Curtain Fig tree, *c.* 2 km SSW of Yungaburra, 5 December 1984, *L.W. Jessup 695* (holo: BRI).

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Xue, B., Su, Y.C.F., Thomas, D.C. & Saunders, R.M.K. (2012). Pruning the polyphyletic genus *Polyalthia* (Annonaceae) and resurrecting the genus *Monoon*. *Taxon* 61: 1021–1039.

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Taeniophyllum walkeri B.Gray (Orchidaceae), a new species from north Queensland

B. Gray

Summary

Taeniophyllum walkeri B.Gray (Orchidaceae) a new species from north Queensland. ***Austrobaileya* 10(1): 65–69.** *Taeniophyllum walkeri* B.Gray is described, illustrated and compared to related taxa. A key to the Australian mainland species is expanded to include the new species. A line drawing and photographs are provided. The species is restricted to the western side of the McIlwraith Range on Cape York Peninsula and is so far only known from three collections.

Key Words: Orchidaceae, *Taeniophyllum*, *Taeniophyllum walkeri*, Australia flora, Queensland flora, McIlwraith Range, new species, taxonomy.

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Introduction

Since the recent publication of three new species of *Taeniophyllum* (Gray 2015), material of a new and distinctive species has been collected in far north Queensland from central Cape York on the western side of the McIlwraith Range to the north east of Coen. *Taeniophyllum walkeri* B.Gray is the second species in the section *Taeniophyllum* (synonym: section *Trachyrhachis* Schltr.) recorded for Australia. The other Australian species in this section, *T. epacridicola* B.Gray, is known from northern Cape York (Gray 2015).

This diminutive orchid was first brought to my attention by James Walker who found a single flowering specimen in April 2008 near to the Leo Creek Mine road in the western McIlwraith Range. This specimen is represented by a photograph only. Later a single flowering plant was collected by Andrew Ford at the same locality in July 2015. Four fruiting plants were located on one tree in the same general area in September 2016 by the author and Mark Nowochatko.

Materials and methods

This study is based on fresh and spirit specimens collected from plants *in situ*. All measurements for floral parts are from fresh material. An expanded key to the Australian mainland species is provided (*cf.* Gray 2015).

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Taxonomy

Taeniophyllum walkeri B.Gray **sp.nov.** Similar to *T. oblongum* Schltr. from New Guinea, but differs in having much larger floral bracts, a cleft apex to the labellum (versus entire) and rugose outer surfaces to the sepals (versus smooth). **Typus:** Queensland. Cook District: Old Leo Creek Mine road, western side of McIlwraith Range NE of Coen, 31 July 2015, *A. Ford 6462* (holo: BRI).

Plant epiphytic. **Roots** 3–5(–6), round in cross section, attached to the host, 50–150 × 1.8–2.3 mm, green. **Inflorescences** usually one or two. **Peduncle** absent or up to 1 mm long. Rachis slightly zig-zag, 4–6 mm long. **Floral bracts** ovate acuminate, 3–4 mm long, glabrous. **Flowers** greenish yellow, *c.* 4.5 mm wide, labellum white with reddish markings. Sepals and petals spreading widely free to the base. **Dorsal sepal** broadly elliptic, obtuse at the apex, *c.* 4.7 × 1.7 mm, projecting forward over the column, concave but thickened near the apex, upper surface somewhat rugose and slightly keeled. **Lateral sepals** oblong, obtuse at the apex, *c.* 4.7 × 1.3 mm, thickened at the apex, outer surface somewhat rugose. **Petals** linear, *c.* 3.8 × 1 mm. **Labellum** thick and fleshy, *c.* 3.5 × 2 mm, channelled on the upper

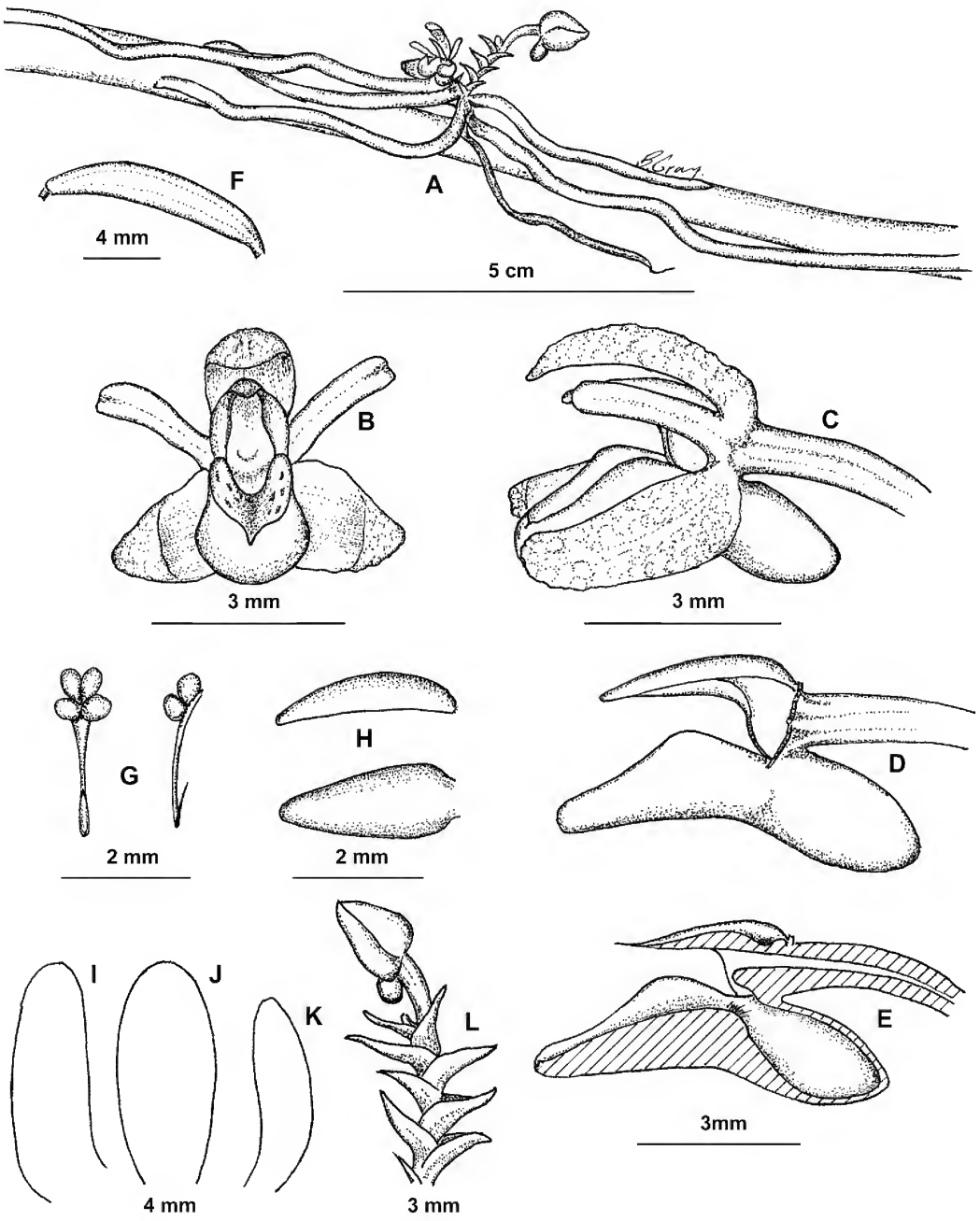

Fig. 1. A. habit of mature flowering plant. B. face view of flower. C. lateral view of flower. D. lateral view of labellum and column. E. longitudinal section of labellum and column. F. fruit. G. pollinium. H. anther. I. lateral sepal. J. dorsal sepal. K. petal. L. inflorescence. All from *Ford 6462* (BRI). Scale as indicated. Del. B. Gray.

surface, side lobes highest towards the rear, apex cleft. **Spur** *c.* 2.2 × 1.6 mm in line with the labellum. **Column** projecting forward, beak like, *c.* 2.5 mm long, creamy yellow with red margins. **Anther cap** lanceolate, *c.* 2.5 × 1 mm. **Pollinia** 4 in unequal pairs. **Stype** slender *c.* 2 mm long. **Capsule** 12–14 × *c.* 3.5 mm. **Figs. 1–3.**

***Additional specimen examined*: Queensland**. Cook District: Leo Creek Mine road, McIlwraith Range, Sep 2016, *Gray 9740 & Nowochatko* (CNS).

***Distribution and habitat*:** *Taeniophyllum walkeri* is endemic to central Cape York where it is known from a restricted area on the Leo Creek Mine road on the western side of the McIlwraith Range north east of Coen. All collections made have been growing on twigs and smaller branches of *Larsenaikia ochreata* (F.Muell.) Tirveng. in relatively open areas near rainforest. *T. muelleri* Lindl. ex Benth. was a very common orchid on the same host tree.

Fig. 2. Mature flowering plant. Inflorescences showing open flower and a flower bud. (*Ford 6462*, BRI). Photo: B. Gray.

***Phenology*:** Flowering collections were made in April and July, and a fruiting collection in September.

***Notes*:** *Taeniophyllum walkeri* is closest to *T. oblongum* Schltr. from Papua New Guinea (Schlechter 1982) but a comparison of floral morphology with the description and line drawing of that species show the plants to be distinct from one another with the former having much larger floral bracts, a cleft apex to the labellum and rugose outer surfaces to the sepals. Schlechter (1982) states that *T. oblongum* was rare and that he located only a single plant, despite a long stay in the Minjem Valley. The type specimen of *T. oblongum* was almost certainly destroyed in Berlin during World War 2.

There are also some similarities to Taeniophyllum breviscapum J.J.Sm. from New Guinea but that species differs in having verrucose, compared to smooth floral bracts.

***Etymology*:** The specific epithet honours entomologist James Walker who discovered this species while doing field work in the area.

Key to mainland Australian species of *Taeniophyllum*

1 Sepals and petals fused near the base forming a tube; flowers < 3 mm diameter **2**
1. Sepals and petals free to the base not forming a tube; flowers > 3 mm diameter **6**

2 Roots terete in cross section . . . . . **T. muelleri**
2. Roots triangular or flattened in cross section **3**

3 Roots triangular in cross section (having a raised longitudinal ridge) . . . **T. triquetroradix**
3. Roots flat in cross section **4**

4 Peduncle filiform **5**
4. Peduncle not filiform, roots 2–3 mm broad; peduncle 2–3 long, floral bracts overlapping, hiding the rachis; flowers 4–5 mm long . . . . . **T. confertum**

5 Roots 1–1.5 mm broad; peduncle filiform, 12–15 mm long; rachis filiform; floral bracts small, alternating *c.* 0.5 mm apart, all in one plane; flowers *c.* 2.5 mm long . . . . . **T. explanatum**
5. Roots *c.* 1 mm or less broad; peduncle filiform, 2–5 mm long; rachis not filiform, fleshy, parallel sided, twice as wide as peduncle; floral bracts alternating < 0.5 mm apart; flowers < 2 mm long . . . . . **T. clementsii**

6 Peduncle, rachis and ovary sparsely covered with erect short-bristly hairs; flowers green, turning yellow with age . . . . . **T. lobatum**
6. Peduncle, rachis and ovary glabrous **7**

7 Peduncle filiform, 20–50(–60) mm long; floral bracts overlapping; flower 7–11 mm wide; roots 1.5–2.5 mm broad, mostly hanging free from host, some appressed . . . . . **T. malianum**
7. Peduncle not filiform **8**

8 Roots flat, 2–3.5(–4) mm broad, greyish green; peduncle and rachis reddish, zig-zag from the base, 8–10 mm long; floral bracts alternating 2–3 mm apart; flower 4.5–5 mm wide . . . . . **T. epacridicola**
8. Roots ± terete in cross section 1.8–2.3 mm diameter, green; peduncle 0–1 mm long, floral bracts overlapping hiding the rachis; flower *c.* 4.5 mm wide . . . . . **T. walkeri**

Fig. 3. Close-up of open flower (*Ford 6462*, BRI). Photo B. Gray.

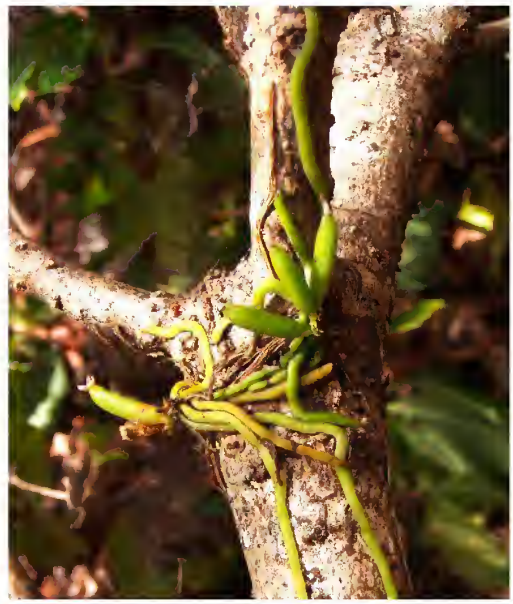

Fig. 4. Fruiting plant (*Gray BG9740 & Nowochatko*, CNS). Photo: M. Nowochatko.

***Acknowledgements*:** I would like thank James Walker for bringing this plant to my attention and providing details of the collection site and host tree. I am indebted to Andrew Ford who went to considerable trouble to collect fertile material for the type specimen. Also, Mark Nowochatko is thanked for his assistance with the field work.

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Melaleuca comosa A.R.Bean (Myrtaceae), a new species from western Queensland

A.R. Bean

Summary

Bean, A.R. (2017). *Melaleuca comosa* A.R.Bean (Myrtaceae), a new species from western Queensland. ***Austrobaileya* 10(1): 70–73.** A new species, *Melaleuca comosa* A.R.Bean is described and illustrated. It is known from a single location near Blackall in western Queensland.

Key Words: Myrtaceae, *Melaleuca, Melaleuca comosa*, new species, Australia flora, Queensland flora

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Introduction

In 1984, Rosemary Purdie made the first herbarium collection of an unusual *Melaleuca* species during field work for the Western Arid Region Land Use Study (WARLUS) project. This specimen could not be classified as it had only a few old fruits. In 1995, noted amateur collector Betty Ballingall visited the site and collected another specimen. This one unfortunately also lacked flowers and intact fruits. She nevertheless sent a duplicate to *Melaleuca* expert Lyn Craven, who tentatively identified it as *M. lasiandra* F.Muell. In the recent comprehensive book on the genus (Brophy *et al*. 2013), Ballingall's collection appears as an outlier on their distribution map for *M. lasiandra*. In 2014, Jenni Silcock and Boris Laffineur were able to procure some material bearing senescent flowers and young fruits. Her material is sufficient to confirm that this taxon differs significantly from *M. lasiandra*, and that it does not conform to any other named species. It is described here as a new species.

Materials and methods

This paper is based on examination and measurements of dried herbarium samples at BRI.

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Taxonomy

Melaleuca comosa A.R.Bean **sp. nov.** with similarities to *M. lasiandra*, but differing by the flaky-fibrous, non-papery bark, the shorter leaves with very dense oil glands, the flowers in monads, the glabrous stamens, and the stamen bundles only 3.5–4.5 mm long. **Typus:** Queensland. Mitchell District: 2.5 km SE of New Belton dam, Mt Marlow, 19 September 2014, *J. Silcock JLS1650 & B. Laffineur* (holo: BRI; iso: CANB, to be distributed).

Melaleuca sp. (Mt Marlow M.E.Ballingall MEB2737); (Bean 2016).

Shrub 2–4 m high, with dense rounded crown. Bark pale to dark grey, flaky-fibrous, not papery, persistent throughout. Branchlets terete to somewhat angular, brown to reddish-brown; hairs dense, white, spreading, eglandular. Leaves simple, entire, spirally arranged. Lamina elliptical to broadly obovate, 7–14.5 × 2.6–5.3 mm, 2.1–3.4 times longer than wide, veinless or with 1–3 veins sometimes faintly visible; oil glands very dense, *c*. 60 per mm^2; hairs simple appressed, silky, 0.1–0.2 mm long, dense on young laminae, becoming glabrous with age; apex acute to mucronate, base cuneate, margins flat. Petioles well developed, 0.8–1.2(–1.4) mm long, flattened. Inflorescences spicate, spikes 15–25 mm long; rachis with dense erect white eglandular hairs; flowers in

monads, 5-(6)-merous, sessile, bracteoles not seen. Hypanthium ovoid-truncate, 2–2.5 mm long, with dense patent white hairs 0.3–0.9 mm long; sepals deltate, 1.2–1.3 mm long, densely hairy on outer surface, sparsely hairy on inner surface, readily deciduous; petals broadly obovate, *c.* 1.5 mm long, hairs present near base on outer surface, inner surface glabrous, oil glands apparently absent. Stamens apparently white, in 5(–6) bundles, 8–16 stamens per bundle, bundles 3.5–4.5 mm long, filaments glabrous; anthers versatile, 0.4–0.5 mm long. Ovary 3-locular; summit of the ovary densely hairy; style 6–6.5 mm long, glabrous; stigma slightly expanded. Mature fruits globose-truncate to cupular, 3–3.5 mm long, 3.3–4 mm diameter, sessile, glabrous or glabrescent, valves of capsule enclosed or at rim-level. **Figs. 1–3**.

Fig. 1. ***Melaleuca comosa.*** A. branchlet with young infructescence ×3; B. mature leaf with copious oil glands ×6; C. staminal bundle ×16; D. immature fruit ×12; E. young developing leaf with silky indumentum ×12. All from *Silcock JLS1650 & Laffineur* (BRI).

Fig. 2. A mature tree of ***Melaleuca comosa***. Photo: J. Silcock.

Fig. 3. Bark of ***Melaleuca comosa***. Photo: J. Silcock.

***Additional specimens examined*:** Queensland. MITCHELL DISTRICT: Mt Marlow Station in Belton paddock, 2.4 km SE along shot line from New Belton Tank, Apr 1995, *Ballingall MEB2737* (BRI, CANB); Twickenham, second lease on Mt Marlow station, Jul 1999, *Burns AZI1586* (BRI); *c.* 11 km WSW of Merrigal homestead, Apr 1984, *Purdie 2086* (BRI).

***Distribution and habitat*:** Known only from Mount Marlow station, about 180 km SW of Blackall in western Queensland. It grows on drainage channels in deeply gilgaied stony clay soils, adjacent to or with *Acacia cambagei* R.T.Baker.

***Phenology*:** Unknown; the late remnants of flowers have been collected in September.

***Affinities*:** The nearest relative is unknown. *Melaleuca comosa* is similar to *M. lasiandra*, but differs by the flaky-fibrous, non-papery bark, the shorter leaves with very dense oil glands, the flowers in monads, the glabrous stamens, and the stamen bundles only 3.5–4.5 mm long. *M. comosa* is superficially like *M. bracteata,* the only other *Melaleuca* species with non-papery bark from western Queensland. *M. comosa* differs by the unveined or 1–3-veined leaves (5–11-veined for *M. bracteata*), the hypanthium hairs 0.3–0.9 mm long (only *c.* 0.1 mm long for *M. bracteata*), the 8–16 stamens per bundle (15–25 for *M. bracteata*), flowers in monads (triads for *M. bracteata*), and the lack of persistent leaf-like bracts at the base of each triad.

***Conservation status*:** The total known extent of occurrence for *Melaleuca comosa* is 5 km^2. The main population covers about 1 km^2, with outliers seen totalling about 0.1 km^2, giving a conservative area of occupancy estimate of 1.1 km^2. The total population is estimated at around 2,200 plants (J. Silcock pers. comm.). Based on the IUCN (2012) criteria, a conservation status of **Vulnerable** (D1 and D2) is proposed.

***Etymology*:** The species epithet is from the Greek *comosus* meaning 'hairy', and is given in reference to the dense patent hairs on the flowering hypanthia.

Acknowledgements

I am grateful to Jennifer Silcock for the photographs, and for her detailed notes on population size and extent of occurrence. Will Smith (BRI) provided the illustrations.

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Cycas distans P.I.Forst. & B.Gray (Cycadaceae), a new species from southern Cape York Peninsula, Queensland

Paul I. Forster & B. Gray

Summary

Forster, P.I. & Gray, B. (2017). *Cycas distans* P.I.Forst. & B.Gray (Cycadaceae), a new species from southern Cape York Peninsula, Queensland. ***Austrobaileya* 10(1): 74–84.** A new species of *Cycas* from the Mitchell River watershed in southern Cape York Peninsula in Queensland is described, illustrated and diagnosed as *C. distans* P.I.Forst. & B.Gray. It is known from two populations and does not occur in any conservation reserves. A conservation status of Endangered is recommended for the species.

Key Words: Cycadaceae, *Cycas*, *Cycas distans*, *Cycas platyphylla*, Australia flora, Queensland flora, Mitchell River catchment, new species, taxonomy, Endangered conservation status

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Introduction

The genus *Cycas* L. has 29 species recognised for Australia (Hill 1998; Forster 2001, 2005, 2011). Although some species are widespread, most tend to occur in geographically discrete areas in few (in several instances one) to many populations, commonly restricted to particular geological substrates. Botanical exploration in remote areas of Queensland continues to reveal previously undocumented populations of *Cycas* of known and previously unknown species. The new species (*C. distans* P.I.Forst. & B.Gray) described in this paper appears to be endemic to the Mitchell River watershed on southern Cape York Peninsula (Rustomji *et al.* 2010; Caitcheon *et al.* 2012) that flows west to the Gulf of Carpentaria. It was probably first collected in 1988 by Christine Dalliston (northern population); however, this collection is scanty (a very small, perhaps juvenile leaf and some loose microsporophylls) and adequate fertile material from this location remains to be recollected. In September 2015 a substantial population was located by Bruce Gray near the Mitchell River (southern population), and fertile material collected. A further visit to this location in late 2015 was undertaken so that a morphological description based on *in situ* plants could be made.

Putative speciation processes in Australian *Cycas* have been discussed previously (Forster 2011) with a favoured model of speciation occurring by genetic drift in isolated populations, rather than genetic selection *per se* (*cf.* Gorelick 2009) with the species often being defined on a combination of many small differences, rather than any major difference in overall habit. *C. distans* is hypothesised to be most closely related to *C. platyphylla* on a morphological basis, existing as a similar appearing species that is geographically disjunct, having diverged initially as an allopatric population from common ancestors. This distribution and speciation pattern is characteristic of *Cycas* in Australia, but particularly over the long latitudinal range for the genus in Queensland.

The known populations of *Cycas distans* are roughly equidistant (150–190 km) to those of three *Cycas* species (*C. media* subsp.

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banksii K.D.Hill, *C. platyphylla*, *C. tuckeri* K.D.Hill); however, these taxa occur in dissimilar habitats and are unlikely to have had any genetic connection with *C. distans* for some time given the large area of apparently unsuitable habitat inbetween. Genetic connectivity in *C. megacarpa* K.D.Hill has been demonstrated to exist to around 8.5 km with populations beyond this distance tending to diverge (James *et al.* 2017), so a distance of 150–190 km for these four northern species, putatively far exceeds the potential for sporadic gene flow. *Cycas platyphylla* is the only other *Cycas* that also occurs in the Mitchell River watershed with populations in the far eastern upper catchment of the Walsh River. The Walsh River eventually combines with the Mitchell River, and the studied population of *C. distans* is only *c.* 10 km to the north of the current day watercourse; whereas both *C. media* subsp. *banksii* and *C. tuckeri* occur in eastern flowing catchments. The Mitchell River catchment drains part of the highly complex geological Hodgkinson Province of Palaeozoic origin (Vos *et al.* 2006) with the location of *Cycas distans* (altitude *c.* 195 m) being to the west of the Palmerville and Mitchell fault zones, whereas *C. platyphylla* is well to the east of these zones at altitudes of 500–840 m.

The distribution of cycad populations is commonly dispersal limited (*cf.* Primack & Miao 1992) insomuch as apparently suitable habitat is abundant but the cycads peter out. Although a number of vertebrates (birds, mammals) putatively disperse cycad seed (Forster 2007; James *et al.* 2017), this dispersal is usually local (*sensu* Cain *et al.* 2000) and mostly within close proximity to the adult plants. The large size and weight of *Cycas* seed precludes both extremely long range (i.e. more than 1 km, *cf.* Corlett 2009) and long range (more than 100 m, *sensu* Cain *et al.* 2000) dispersal by everything apart from gravity and water. Rivers are important dispersal corridors for plants (Merritt & Wohl 2002) and the waterways that form the Mitchell River catchment have been eroding the landscape for millennia so it is not inconceivable that directed dispersal of cycad seed has occurred down the catchment due to the unidirectional water flow (*cf.* Pulliam 1988) which currently has a very large discharge volume (>8 000 000 ML/year) (DNRM 2017; Brooks *et al.* 2009). Nevertheless, such a dispersal event (or events) must have not been a normal occurrence, but rather from an extreme or chance event (Higgins *et al.* 2003; Nathan 2006) such as catchment flooding and the landscape in which it occurred would not have been the same as that existing now. An analogous dispersal/speciation scenario has been described for *Livistona* palms (Kondo *et al.* 2012) that have seeds of a similar size and that morphologically appear suited to similar dispersal vectors. This dispersal scenario is compounded for cycads due to their dioecious nature and potential dependence on insects for pollination (Kono & Tobe 2007; Terry *et al.* 2009). An alternative hypothesis is that the cycad populations were continuous in the past and that extinction of the intervening populations has eventuated in the current disposition with the two species diverging morphologically.

Materials and methods

The species description is based on examination by both authors of live plants in habitat and herbarium collections at the Australian Tropical Herbarium (CNS) and the Queensland Herbarium (BRI). The structure of the description is modelled on that for *Cycas terryana* P.I.Forst. (Forster 2011).

Taxonomy

Cycas distans P.I.Forst. & B.Gray **sp. nov.** with affinity to *C. platyphylla* but differing in the more robust habit (stems to 3.5 m tall and 15–30 cm diameter versus to 1.5 (?4) m tall and 10–15 cm diameter), longer median leaflets (130–236 mm long versus 90–170 mm long), very small (12–20 × 4–8 cm), narrowly-ovoid male cones (versus larger (15–20 × 8–11 cm) and ovoid) and much smaller megasporophylls 9–16 cm long (versus 6–32 cm long), with a smaller lamina 25–35 × 19–30 mm (versus 50–80 × 16–37) and with shorter apical spines (5–10 mm long versus 20–25 mm long). **Typus:** Queensland. Cook District: Mitchell River catchment, 25 September 2015, *B. Gray 9689 & S. Kitchener*

(holo: BRI [3 sheets + carpological]; iso: CNS *distribuendi*).

Arborescent cycad with stems to 3.5 m high (rarely multiheaded with 2 heads), 15–30 cm thick and with a bulbous base. Leaves 60–117 cm long, somewhat wavy towards the apex, strongly keeled in cross-section, olive-green, initially strongly blue-grey and tomentose; opposing leaflets inserted at 30–45° to the rachis and becoming flatter with age, the rachis usually terminated by paired leaflets, tomentose, glabrescent; petiole 25–34 cm long, 4–8 mm diameter, strongly blue-grey tomentose above, and dull olive green below, with 0–26 short teeth (pinnacanths) at top of petiole, 2–3.5 mm long and spaced 8–9 mm apart, often spineless. Leaflets 156–244 per leaf, 8–10 mm apart, straight to inflexed forward towards top of leaf, evenly spaced in lower half of leaf, then becoming more interleaved and more strongly keeled in upper half of leaf, flexible, margins recurved; median leaflets at 30–50° to the rhachis, 130–236 mm long, 5.5–6.5 (–8.5) mm wide, olive-green with glaucous blue pruinose bloom when young; ± flat in cross section, decurrent for 4–12 mm, absent at base of leaf, midrib slightly raised above, more prominent below and yellowish. New growth densely tomentose with ferruginous-brown indumentum, glabrescent. Cataphylls initially soft, soon pungent, linear, 8–10 cm long, densely tomentose for entire length with fawn-ferruginous indumentum, more ferruginous-brown near base. Microsporangiate cones narrowly-ovoid, 12–20 cm long, 4–9.5 cm diameter, with dense fawn-ferruginous indumentum; microsporophylls 14–28 mm long, fertile zone 8–15 mm long, 4–9 mm wide; apical spine antrorsely recurved, 4–7 mm long. Megasporophylls 9–16 cm long, when young with dense ferruginous-brown indumentum, aging grey, eventually glabrescent and olive-green; ovules 2 to 4; lamina broadly triangular 25–35 mm long, 19–30 mm wide, strongly dentate with well developed, antrorse teeth 2–4 mm long, apical spine 5–10 mm long. Seeds ovoid, 28–32 mm long, 23–29 mm diameter, sarcotesta *c.* 3 mm thick, blue pruinose, olive green beneath wax covering, cream-yellow then becoming purplish-red when ripe. **Figs. 1–13.**

Fig. 1. ***Cycas distans*** habitat (population vouchers. *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

Fig. 2. ***Cycas distans***. Large individual with S. Kitchener for scale (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

***Additional specimens examined*: Queensland.** Cook District: On Pinnacle to Kimba Road, Jun 1988, *Dalliston CC41* (BRI); Mitchell River catchment, Sep 2015, *Gray 9688 & Kitchener* (BRI, CNS); *ibid.*, Sep 2015, *Gray 9690 & Kitchener* (BRI, CNS), *ibid.*, Nov 2015, *Forster PIF43235A, Kitchener & McDonald* (BRI), *ibid.*, Nov 2015, *Forster PIF43235B, Kitchener & McDonald* (BRI).

***Distribution and habitat*:** The two populations both occur in the Mitchell River catchment. Plants occur as dense to sporadic populations in bloodwood – stringybark woodland dominated by *Eucalyptus tetrodonta* F.Muell. with occasional *Corymbia clarksoniana* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson and *Erythrophleum chlorostachys* (F.Muell.) Baill., on red sandy soil derived from laterised surfaces at altitudes between 195 and 240 m above sea level.

***Notes*:** A superficial examination of the southern cycad population immediately gives the impression that the plants are overall very similar to *Cycas platyphylla*, but noticeably trunked to 3.5 m tall and with thicker stems (**Figs. 1 & 2**). *Cycas platyphylla* invariably occurs in skeletal soils on rocky slopes (metasediments and volcanics such as granites and rhyolites) and it is rare to find individuals that are more than 1.5 m tall with records of plants 2 m high usually including the leaves as part of the overall measurement. Hill (1992) mentions "rarely to 4 m"; however, we have not observed individuals to this height. The two species differ most noticeably by leaf morphology and male reproductive features. *C. distans* has longer median leaflets, very small, narrowly-ovoid male cones and much smaller megasporophylls (**Table 1**). The leaflets of *C. distans* do also appear as more apically inflexed than in *C. platyphylla*; however, examination of herbarium material of the latter found that this also occurs in that species. There are also some apparent differences in indumentum cover and colour on the cataphylls and megasporophylls (**Table 1**); however, this can vary depending on environmental conditions and subjectivity, hence it is not emphasised in the current comparison.

Table 1. Comparison of character states for *Cycas distans* and *C. platyphylla*

Character State	*C. distans*	*C. platyphylla*
Stem size	to 3.5 m tall × 15–30 cm diameter	to 1.5 (?4) m tall × 10–15 cm diameter
Median leaflet size (length × width in mm)	130–236 × 5.5–6.5 (–8.5)	90–170 × 4–6
New growth indumentum colour*	ferruginous-brown	orange-brown
Leaflet colour mature leaves*	olive-green after being initially blue-grey	olive-green after being initially bluish
Cataphyll indumentum colour*	ferruginous-fawn	orange-brown
Microsporangiate cones	narrowly-ovoid, 12–20 × 4–8 cm	ovoid, 15–20 × 8–11 cm
Megasporophyll dimensions	9–16 cm long; lamina 25–35 × 19–30 mm; apical spine 5–10 mm long	16–32 cm long; lamina 50–80 × 16–37; apical spine 20–25 mm long

*colours are variable depending on age and environmental conditions

Fig. 3. ***Cycas distans***. New expanding leaves demonstrating indumentum colour and cover (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

Fig. 4. ***Cycas distans***. Individual photographed in September, demonstrating glaucous blue colour of leaves (population voucher: *Gray 9688*, BRI). Photo: B.Gray.

Fig. 5. ***Cycas distans***. Multiheaded individual resulting from past damage to growing point (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

Fig. 6. ***Cycas distans***. Leaves showing inflexion of leaflets (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

Fig. 7. ***Cycas distans***. Shoot apex of female plant with young expanding megasporophylls surrounded by cataphylls (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: K.R. McDonald.

Fig. 8. ***Cycas distans***. Female plant with old megasporophylls (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

***Etymology*:** The species epithet is from the Latin *distans* (the present participle of *distō*) and means 'standing apart', an allusion to the disjunct occurrence of this species.

***Conservation status*:** The species is known from two populations with only one of these having been examined this century. At the single population that has been visited, there is probably less than 1000 plants in total scattered over an area of two or three hectares, with very few seedlings or juvenile plants evident (**Fig. 13**). Whilst there are no known obvious threats to the species (apart from inappropriate fire regimes that may impact on reproduction and recruitment [*cf.* Forster 2007]), the number of populations and individuals warrant the species being listed as **Endangered** on the criterion B2 (a,b) (IUCN 2001). This area of southern Cape York Peninsula has been inadequately explored for flora away from roads and tracks so potentially more populations of this species may be yet discovered. The general habitat type where the species has been found is widespread in the region, so causal threatening processes common to many cycads (failure of recruitment leading to skewed population structures, lack of dispersal despite available habitat) (Forster 2007) appear to be operating.

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Thanks to Colin Hughes for initially locating the southern population. Stephen Kitchener and Keith McDonald ably assisted with fieldwork.

Fig. 9. ***Cycas distans***. Male plant with cone at pollen shedding stage (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: K.R. McDonald.

Fig. 10. ***Cycas distans***. Male plant with old dried cone (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

Fig. 12. ***Cycas distans***. Mature seed cleaned of sarcotesta (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

Fig. 13. ***Cycas distans***. Clumped seedlings around an adult female plant (population vouchers: *Forster PIF43235A & B et al.*, BRI). Photo: P.I.Forster.

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SHORT COMMUNICATION

Rhaphidospora platyphylla (S.Moore) Bremek. ex A.R.Bean (Acanthaceae), a new combination for a species from Australia and New Guinea

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Rhaphidospora Nees (Acanthaceae) is represented in Australia by three species, although only two (*R. bonneyana* (F.Muell.) R.M.Barker and *R. cavernarum* (F.Muell.) R.M.Barker) were recognised by Barker (1986). Two species occur on Cape York Peninsula, Queensland (*R. cavernarum* and a second newly recognised here). One specimen of this second species (*Hann 356*) was identified as *R. cavernarum* (Barker 1986), but it is now clear that this and other material from Cape York Peninsula matches the type of *Justicia platyphylla* S.Moore, described from Papua New Guinea.

In a paper describing new species of Acanthaceae from New Guinea, Bremekamp (1957) mentioned that *Justicia platyphylla* S.Moore rightfully belonged in *Rhaphidospora*, and he coined the name *Rhaphidospora platyphylla* (S.Moore) Bremek. at that time. This name has been used in various plant name databases (e.g. IPNI 2017; The Plant List 2017) in recent years. However, the combination was not validly made, because Bremekamp failed to give the full bibliographic reference for the place of publication of the basionym. This is a requirement for all combinations made after the 1st January 1953 (McNeill *et al.* 2012, Art. 41.5). The combination is here validated.

Rhaphidospora platyphylla (S.Moore) Bremek. ex A.R.Bean, **comb. nov.;** *Justicia platyphylla* S.Moore, *J. Bot.* 58: 193 (1920). **Type:** Papua New Guinea. Central Province: Astrolabe Range, 1 August 1918, *C.T. White 270* (holo: BM, image seen; iso: BRI).

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***Additional specimens examined*: Queensland.** Cook District: Chuula outstation, Kaanju nation, Central Cape York, Jun 2007, *Smith 5209 & Nelson* (BRI); Round Mountain, Embley Range, Jun 1992, *Forster PIF10482 & Tucker* (AD, BRI, K, L, MEL); Round Mountain, Embley Range, Jul 1997, *Forster PIF21344 et al.* (BRI, CNS); Bathurst Range, 19 km SSE of Bathurst Head, 55.8 km NE of Lakefield Ranger Base, catchment of Barrumundi Creek, Jul 1994, *Fell DGF4496 et al.* (BRI); NPR 166, Black Mountain, Helenvale road, Mar 2001, *Ford AF2648 & Holmes* (AD, BRI, NSW).

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Gastrodia umbrosa B.Gray (Orchidaceae, Gastrodieae): A new mycoheterotrophic orchid endemic to the Atherton Tableland, Queensland, Australia

B. Gray & Y.W. Low

Summary

B.Gray & Y.W.Low (2017). *Gastrodia umbrosa* B.Gray (Orchidaceae, Gastrodieae): A new mycoheterotrophic orchid endemic to the Atherton Tableland, Queensland, Australia. ***Austrobaileya* 10(1): 86–92**. *Gastrodia umbrosa* B.Gray, a new mycoheterotrophic orchid is described and illustrated. It was recently discovered from the submontane rainforest of the Atherton Tableland in north Queensland. *Gastrodia umbrosa* is morphologically similar to *G. queenslandica* Dockrill but differs in having dark purplish brown flowers with tepals fused for almost the entire length as opposed to brownish orange flowers and tepals fused for two-thirds the length. A taxonomic key to tropical Queensland *Gastrodia* species is provided.

Key Words: Orchidaceae, *Gastrodia*, *Gastrodia umbrosa*, Australia flora, Queensland flora, new species, taxonomy, identification key

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Introduction

Gastrodia R.Br. is a genus of about 70 species of achlorophyllous, mycoheterotrophic terrestrial orchids distributed from tropical Africa through to Asia, Australia and New Zealand (Cribb *et al.* 2010; Govaerts *et al.* 2017). The genus is typified by *G. sesamoides* R.Br., a native of Australia and New Zealand where it is popularly known as the Potato Orchid (Brown 1810; Jones 2006). A comprehensive revision of the genus is still lacking (Pridgeon *et al.* 2005), and for the past few years many new taxa have been discovered and named, e.g., China (Hu *et al.* 2014), Japan (Suetsugu 2014, 2016), Madagascar (Martos *et al.* 2015), New Zealand (Lehnebach *et al.* 2016), the Philippines (Pelser *et al.* 2016) and Solomon Islands (Hsu *et al.* 2016).

In 2004, *Demorchis* D.L.Jones & M.A.Clem., a segregate genus from *Gastrodia* was established to accommodate two taxa, namely *G. papuana* Schltr. and *G. queenslandica* Dockrill that have (1) presence of filamentous roots that emerge from the apex of the rhizome, (2) short inflated flowers, (3) thick fleshy sepals, and (4) thick and longer peduncle and pedicel at fruiting stage (Jones & Clements 2004). The distinction of these two genera were purportedly supported by a phylogeny inferred from molecular research using only the internal transcribed spacer (ITS) region of the nuclear ribosomal DNA. However, this genus is considered to be a synonym by Merckx *et al.* (2012) and Govaerts *et al.* (2017). As *Gastrodia* is not monographed, we wish to adopt the stance of Pridgeon *et al.* (2005), Merckx *et al.* (2012) and Govaerts *et al.* (2017) in this paper and continue to accept *Gastrodia* as a broadly circumscribed genus while awaiting further molecular phylogenetic resolution that may appear with a more comprehensive taxon sampling and markers.

In Australia, 10 species of *Gastrodia* have been enumerated, but only three species are recorded for tropical Queensland, namely *Gastrodia crebriflora* D.L.Jones, *G. queenslandica* Dockrill and *G. urceolata* D.L.Jones (Dockrill 1992; Jones 2006;

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Jones *et al.* 2010). A recent collection from Baldy Mountain Forest Reserve, Atherton Tableland, represents a fourth taxon previously unrecorded and distinct in floral morphological characteristics from all known tropical *Gastrodia* taxa recorded for Queensland and Australia. This taxon is morphologically similar to *G. queenslandica* but differs in having dark purplish brown flowers with tepals fused for almost the entire length whereas *G. queenslandica* has brownish orange flowers with tepals fused for two-thirds of the length. Hence, the species is new and described here as *Gastrodia umbrosa*.

Materials and methods

Conventional methods of herbarium taxonomy were applied for this study including examination of living plants in the field and preserved spirit collections deposited in BRI and CNS (herbarium acronym follow Thiers (continuously updated)). Measurements were taken from spirit materials, namely *Gray et al. BG9771* (BRI, CNS) and *Gray BG9772* (CNS).

Key to tropical Queensland *Gastrodia*

1 Inflorescences 20–150 cm high; flowers bell-like (tepals spreading at the apex), white to pale creamy brown (generally occurring in open forest) **2**

1. Inflorescences < 12 cm high; flowers tubular (tepals not spreading at the apex), brownish orange to dark brown or dark purplish brown (generally occurring in dense rainforest) **3**

2 Inflorescence 20–150 cm high; flowers 10–50, obliquely erect; labellum 10–12 × 3–5 mm; callus with three yellow ridges fusing into a single ridge . . . . . **G. urceolata**

2. Inflorescence 50–100 cm high; flowers 10–35, pendulous; labellum 12.5–14 × 7–8 mm, callus of two primary ridges . . . . . **G. crebriflora**

3 Inflorescence 2–8 cm high; flowers 1–2(3), horizontal to slightly nodding, brownish orange, 8–12 mm long; tepals fused for c. ⅔ of the entire length . . . . . **G. queenslandica**

3. Inflorescence 4–12 cm high; flowers 1–4, horizontal, dark purplish brown, 10–12 mm long; tepals fused for almost the entire length . . . . . **G. umbrosa**

Taxonomy

Gastrodia umbrosa B.Gray, **sp. nov.** Similar to *G. queenslandica* Dockrill but differs in having dark purplish brown flowers with tepals fused for almost the entire length (versus brownish orange flowers with tepals fused for two-thirds of the length). **Typus:** Queensland: Cook District: Atherton, Baldy Mountain Forest Reserve, 14 February 2017, *B. Gray, T. Hawkes, T. de Groot, W. Cooper, R. Jensen & B. Hyland BG9771* (holo: BRI; iso: CNS).

Plant a glabrous, leafless, achlorophyllous herb. ***Rhizome*** subterranean, fleshy, creamy-brown 25–60 × 4–8 mm. ***Stem*** erect, 30–50 mm tall, glabrous, pale brown to cream, with 3–6 clasping scale leaves. ***Scale leaves*** 4–6 mm long, acuminate. ***Inflorescence*** 15–22 mm long, with (1–)2–5 flowers; rachis 8–12 mm long; floral bracts lanceolate, 3–6 × 2.5 mm, acute. ***Pedicel*** slender, twisted, 6–10 mm long. ***Flowers*** tubular, opening only narrowly at the apex, dark reddish brown to deep blackish brown but slightly paler at the apex; labellum green, visible only in open flowers, emerald green at the apex. ***Dorsal sepal*** fleshy,

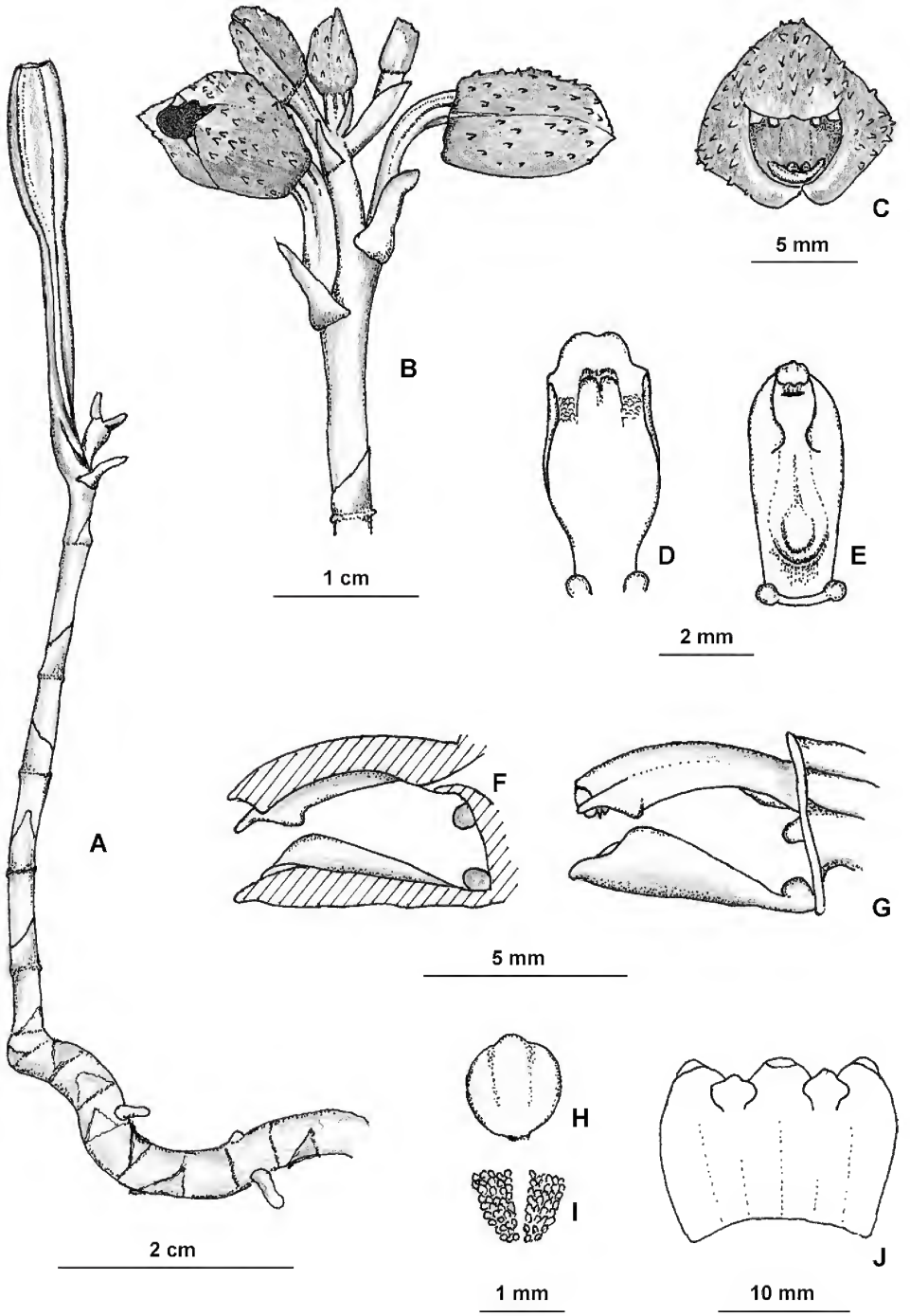

Fig. 1. ***Gastrodia umbrosa***. A. fruiting plant. B. close-up of an inflorescence. C. face view of flower. D. face view of labellum. E. face view of column. F. longitudinal section through column and labellum. G. lateral view of column and labellum. H. anther cap. I. pollinia. J. sepals and petals artificially spread open. A from *Gray BG9772* (CNS), B–J from *Gray et al. BG9771* (BRI, CNS). Scale as indicated. Del: B. Gray.

Fig. 2. *Gastrodia umbrosa*. Plant *in situ.* From *Gray et al. BG9771* (BRI, CNS). Photo: B. Gray.

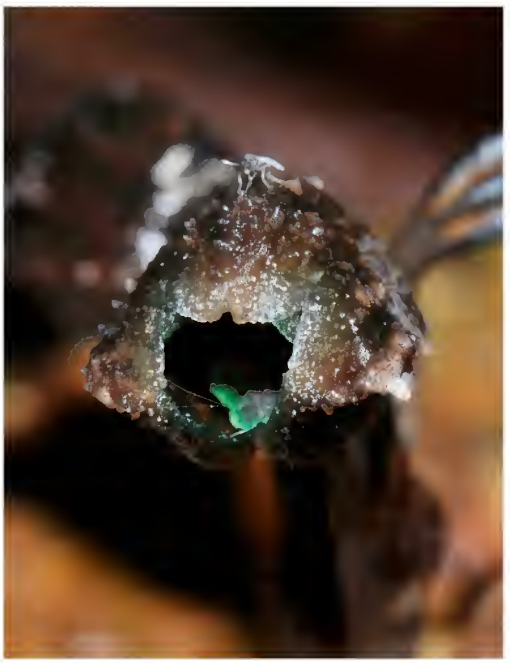

Fig. 3. ***Gastrodia umbrosa***. Close-up view of an open flower. From *Gray et al. BG9771* (BRI, CNS). Photo: T. Hawkes.

Fig. 4. ***Gastrodia umbrosa***. Lateral view of column & labellum. From *Gray et al. BG9771* (BRI, CNS). Photo: B. Gray.

oblong, obtuse, 11–12 × 7–8 mm, connate with lateral sepals for almost their total length, verrucose adaxially. ***Lateral sepals*** fleshy, oblong obtuse, 11–12 × 6–6.5 mm, connate with each other and dorsal sepal, verrucose adaxially. ***Petals*** fleshy, ovate to spathulate, *c.* 3 × 3 mm, adnate to the inner surface of the perianth tube. ***Labellum*** inserted at the apex of the column-foot, free, completely enclosed in the perianth tube, fleshy, green, oblong, canaliculate, broadly acuminate, *c.* 5.5 × 3.5–4 mm, narrowed at the base with two globose processes on the column-foot. ***Column*** orange, hooded, *c.* 5.3 × 2.5 mm, with two apical stelidia extending forward of the anther, two globose, dark green processes occur on the column-foot at the base of the column. ***Fruit*** erect, cylindrical, truncate distally and tapered towards the base, creamy brown, 15–16 × 5–6 mm; pedicel elongated, 18–20 mm long. **Figs. 1–5**.

***Additional specimen examined*:** Queensland. Cook District: Atherton, Baldy Mountain Forest Reserve, Feb 2017, *Gray BG9772* (CNS).

***Distribution and habitat*:** *Gastrodia umbrosa* is, as yet, known only from a single site in the Baldy Mountain Forest Reserve growing on granitic substrate in submontane rainforest at about 1000 m elevation.

***Phenology*:** Flowering is recorded in February with dehiscence of fruit occurring less than two weeks after flowering.

***Notes*:** Seed pods of *Gastrodia umbrosa* were observed on an elongated upright pedicel that developed rapidly soon after flowering. This post-pollination growth is an adaption in relation to seed dispersal which was well documented and observed in *G. exilis* Hook.f.

Fig. 5. ***Gastrodia umbrosa***. Close-up view of column. From *Gray et al. BG9771* (BRI, CNS). Photo: B. Gray.

in Thailand (Pedersen *et al.* 2004). Upon dehiscence of seed pods, the plant gradually dies back.

***Etymology*:** From Latin, *umbra* (shade), in reference to its preferred habitat under deep shade, in moist and damp forest floor of the submontane rainforest.

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We would like to record our sincere thanks to Tim Hawkes who made the initial discovery of *Gastrodia umbrosa* and drew BG's attention to it. Tim Hawkes, Tony de Groot, Wendy Cooper, Rigel Jensen & Bernie Hyland kindly helped in the field to search for additional materials of this elusive orchid for this study. We are also grateful to the Director of the Australian Tropical Herbarium (CNS), Professor Darren Crayn for his continuous support and permission to access the collection; Frank Zich (CNS) provided curatorial assistance at the herbarium. YWL is grateful to Prof David Burslem (University of Aberdeen), Dr David Middleton (SING) and Dr Eve Lucas (K) for encouragement to collaborate with BG. Research opportunity of YWL provided by the National Parks Board, Singapore through the Singapore Botanic Gardens is gratefully acknowledged.

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Oldenlandia pinifolia (Wall. ex G.Don) Kuntze (Rubiaceae), a new addition to the flora of Australia

John O. Westaway

Summary

J.O.Westaway (2017). *Oldenlandia pinifolia* (Wall. ex G.Don) Kuntze (Rubiaceae), a new addition to the flora of Australia. ***Austrobaileya* 10(1): 93–101.** The annual herb *Oldenlandia pinifolia* is newly recorded for Australia with a population in Garig Gunak Barlu National Park on the Cobourg Peninsula of the Northern Territory. The species is described and illustrated based on Australian material, together with assessments of its indigenous and conservation status.

Key Words: Rubiaceae, *Hedyotis*, *Oldenlandia*, *Oldenlandia pinifolia*, *Scleromitrion*, Australia flora, Northern Territory flora, taxonomy, new species record

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Introduction

The savannah woodlands of northern Australia support a rich flora of annual forbs whose lifecycles are completed during the monsoonal wet season. This annual flora is frequently dominated by the monocot families Poaceae and Cyperaceae but also includes many dicots derived from a diverse array of plant families. Rubiaceae may be better known for its rich tropical forest flora of perennial trees and shrubs but is also well represented by an annual herbaceous flora. For example the genus *Spermacoce* L. has 57 species in the Northern Territory (NT Herbarium 2015) and Halford's (1992) review of *Oldenlandia* and related Rubiaceae listed 20 *Oldenlandia* L. species and four *Hedyotis* L. distributed across the northern half of Australia. There are presently 14 *Oldenlandia* species recognised in the NT including three endemic species (NT Herbarium 2015).

Material of a Rubiaceous herb was collected during a plant health survey conducted by the Northern Australia Quarantine Strategy (NAQS) of the Australian Department of Agriculture and Water Resources in June 2015 at Garig Gunak Barlu National Park (GGBNP) on the Cobourg Peninsula. Such surveys inspect host plants at settled locations across northern Australia as part of a surveillance program aimed at early detection of plant pest and disease incursions. The specimen (*Westaway 4819*) was later identified by Ian Cowie at the Northern Territory Herbarium (DNA) to be *Oldenlandia pinifolia* (Wall. ex G.Don) Kuntze using the description and key in the *Flora of China* (Chen & Taylor 2017) where it is referred to as *Hedyotis pinifolia* Wall. ex G.Don. Review of the unidentified *Oldenlandia* specimens held at the NT Herbarium (DNA) revealed a single 1987 collection (*Clarke 1059*) from Smith Point, Cobourg Peninsula, originally lodged as *Borreria* sp., that was also determined to be *O. pinifolia.*

This paper provides a description and illustrations of *Oldenlandia pinifolia* and discusses its occurrence and putative indigenous status in Australia.

Materials and methods

The description below is based on the measurements of dried and fresh material collected at Cobourg Peninsula. Photographs of fresh floral parts were taken under microscopy. Accessions of undetermined *Hedyotis* and *Oldenlandia* material lodged at DNA were subsequently examined. The Vegetation Site Database of floristic surveys

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in the NT maintained by NT Department of Land Resource Management was also reviewed for *Oldenlandia* records from Cobourg Peninsula. Photos are by the author except where otherwise credited.

Taxonomy

Oldenlandia pinifolia (Wall. ex G.Don) Kuntze, *Revis. Gen. Pl.* 1: 292 (1891); *Hedyotis pinifolia* Wall. ex G.Don, *Gen. Hist.* 3: 526 (1834); *Scleromitrion pinifolium* (Wall. ex G.Don) R.J.Wang, *J. Trop. Subtrop. Bot.* 22: 440 (2014). **Type:** Myanmar. Amherst, in 1827, *N. Wallich Cat. no. 850* (holo: K-W [K 001110062]).

Annual **herb** to 20 cm tall with stout fibrous root mass. **Stems** wiry, dark reddish and hispid, sub-terete to 4-angled by way of striate longitudinal ridges. **Stipules** adnate to leaf bases, *c.* 0.5 mm long, 1–1.5 mm wide; base truncate; with 4 or 5 bristles 2–3 mm long. **Leaves** subsessile, opposite, linear, 6–20 mm long, 1–2 mm wide, punctate, sparsely hispid to scabrid adaxially, plano-convex in section with prominent midrib; apex acute; margins slightly thickened, revolute on drying. **Inflorescence** axillary or in short axillary fascicles, subtended by setose bracts to 2 mm long and sometimes also 1 or 2 reduced leaves. **Flowers** 1 to 10, subsessile or with pedicel to 1 mm long. **Hypanthium** obconical, ridged, hispid and swollen in fruit. **Calyx** 2–3 mm long, triangular with midvein conspicuous; lobes 4, 0.6–1.2 mm, < 1/2 calyx length, glabrescent with hispid margins. **Corolla** white to pink, glabrous externally; tube 1–2 mm long; lobes 4, 1–2 mm long, oblong, incurved at acute apex. **Stamens** 4, exserted; filaments attached at corolla sinus; anthers oblong *c.* 0.5 mm. **Pistil** *c.* 1 mm, exserted; stigma bifid. **Capsule** ovoid, dehiscing apically, 1.6–3 × 1–2 mm enclosed in remnant hypanthium. **Seeds** numerous, polyhedral, *c.* 0.3 × 0.2 mm with brown reticulate testa. **Figs. 1–10.**

***Additional specimens examined*: Northern Territory.** Darwin & Gulf District: Smith Point Camp Site 2, Cobourg Peninsula, Jun 2015, *Westaway 4819* (CANB, DNA,); Feb 2017, *Westaway 5206* (DNA); 2.3 km N Black Point & 1.67 km SE Smith Point, Feb 2017, *Westaway 5211* (BRI, DNA); Cobourg Peninsula, May 1987, *Clarke 1059* (DNA).

***Distribution and habitat*:** The native geographic range of *Oldenlandia pinifolia* is south-east Asia including southern China, Nepal, southern India, Myanmar, Thailand, Vietnam and Malaysia (Chen *et al.* 2010; Chen & Taylor 2017; The Herbarium Catalogue 2017) and Brunei, Cambodia and Laos (National Herbarium of the Netherlands database 2017). Chen & Taylor (2017) record this species from six Chinese provinces and Neupane *et al.* (2015) cite collections from China, Thailand and Indonesia. *O. pinifolia* is recorded for the island of Singapore (Chong *et al.* 2009 as *H. pinifolia*) and also from sandy areas of two provinces in Java (Backer & Bakhuizen van den Brink 1965 as *H. pinifolia*). The nearest known location to Australia where *O. pinifolia* has been recorded is in Manggarai, Flores, Nusa Tenggara, Indonesia, based on a 1981 specimen (L2916754) held at Leiden (National Herbarium of the Netherlands database 2017).

In Australia the species has been found only on the Cobourg Peninsula at the northern most part of the Northern Territory. On Cobourg Peninsula, the species has only been recorded from Smith Point (**Map 1**), where it occurs in intact native coastal dune vegetation comprising a coastal sandplain grassland with *Enneapogon pallidus* (R.Br.) P.Beauv., *Sida pusilla* Cav., *Tephrosia remotiflora* F.Muell. ex Benth., *Ptilotus conicus* R.Br., *Zornia* sp. and *Notoleptopus decaisnei* (Benth.) Voronts. & Petra Hoffm. However, targeted survey elsewhere has not been undertaken and given that there exists substantial areas of similar coastal habitats within the extensive GGBNP, the occurrence of further populations is likely and *O. pinifolia* is probably more widespread than current records indicate.

***Phenology*:** Flowering and fruiting of this annual herb occurs during the northern monsoon season between December and April. Plants have been observed flowering at a young (small size) stage in February and in fruit in June after plants have dried.

***Typification*:** Don (1838) cited a single element in the Wallich herbarium when naming *Hedyotis pinifolia*; this is regarded as the holotype.

Fig. 1. Coastal dune swale habitat of ***Oldenlandia pinifolia*** at Cobourg Peninsula.

***Notes*:** From their phylogeny of the *Hedyotis/ Oldenlandia* complex, Guo *et al.* (2013) proposed the resurrection of the genus *Scleromitrion* to accomodate a clade of species previously recognised under *Oldenlandia*. *Scleromitrion* Wight & Arn. was first described in 1834 as a section of *Hedyotis* and subsequently elevated to generic rank by Meisner (1838).

Guo *et al.* (2013) recognized the generic name *Scleromitrion* for a group primarily based on the presence of homostylous flowers with exserted stamens and styles. They note that *Scleromitrion* resembles *Oldenlandia* morphologically in terms of plant habit and capsule and stipule characters, but can be distinguished by their inflorescence and flower traits. *Oldenlandia s. str.* usually has terminal or axillary panicles with obvious or very short peduncles and 2–5-pedicelled flowers in each peduncle. In contrast, *Scleromitrion* has either axillary clusters of 2–5-sessile flowers or a single flower with a long and slim pedicel that is borne terminally or axillarily (Guo *et al.* 2013). Neupane *et al.* (2015) also constructed a phylogenetic tree based on combined nuclear and plastid molecular data which again placed *Oldenlandia pinifolia* in part of a clade termed *Scleromitrion*, characterised by homostylous flowers with exserted stamens and styles.

Scleromitrion is distributed in Asia, Africa, and Australia, and *Oldenlandia s. str.* is mainly limited to Africa, except for the pantropical species, *O. corymbosa* L. (Guo *et al.* 2013). The genus *Scleromitrion* is not presently recognised in Australia (APC 2017).

Cobourg Peninsula has a history of early settlement and a plausible historic pathway for introduction of foreign plants via seed was in association with the importation of banteng cattle (*Bos javanicus*) from Indonesia in 1849. *Oldenlandia pinifolia* was collected in 2015 at

Fig. 2. ***Oldenlandia pinifolia***. Habit of flowering plants.

Fig. 3. ***Oldenlandia pinifolia***. Stem node with stipule (*Westaway 5211*, DNA). Photo: Ying Y. Luo.

Fig. 4. ***Oldenlandia pinifolia***. Flowering stem (*Westaway 5211*, DNA). Photo: Ying Y. Luo.

Fig. 5. ***Oldenlandia pinifolia***. Lateral view of flower (*Westaway 5211*, DNA). Photo: Ying Y. Luo.

Fig. 6. ***Oldenlandia pinifolia***. Dissected flower laid out to demonstrate aestivation and stamens (*Westaway 5211*, DNA). Photo: Ying Y. Luo.

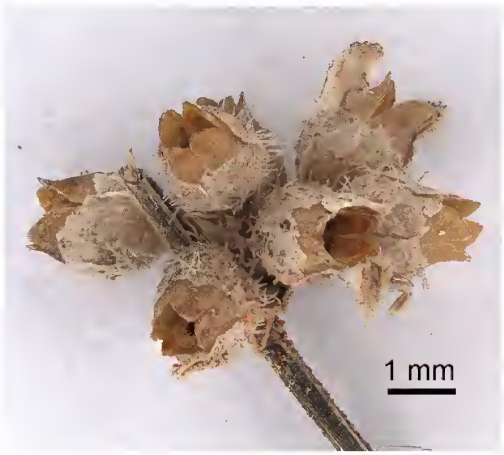

Fig. 8. ***Oldenlandia pinifolia***. Infructescence with fruiting capsules (*Westaway 4819*, DNA). Photo: Ying Y. Luo.

Fig. 7. ***Oldenlandia pinifolia***. Corolla (*Westaway 5211*, DNA). Photo: Ying Y. Luo.

a camping site at GGBNP where small annual plants remained alive during the dry season due to runoff received from a shower amenity block. Dried plants were also seen at the nearby airstrip. As *O. pinifolia* was associated with the ruderal weeds *Phyllanthus amarus* K.Schum. & Thonn. and *Euphorbia hirta* L. at the campground and in disturbed soil at the airstrip it was thought that the species was an introduction.

However, on a subsequent inspection during the 2016–17 wet season, *O. pinifolia* was found within intact native coastal dune vegetation (**Fig. 1**). Abundant *O. pinifolia* seedlings were present there in February in well-drained sandy loam of the hind dune swale (**Fig. 10**).

Fig. 9. ***Oldenlandia pinifolia***. Seeds (*Westaway 4819*, DNA). Photo: Ying Y. Luo.

The 1987 specimen (*Clarke 1059*) describes the habitat as a tall eucalypt woodland with species of *Acacia*, *Planchonia* and *Flueggea* and lacks reference to disturbance or associated exotic species, suggesting that the collection was also made from intact native vegetation.

Bean (2007) put forward criteria and a key to determine the origin status of non-endemic plants in Australia. Despite a lack of historical evidence such as early herbarium records (probably overlooked as inconspicuous annual) and equivocal ecological evidence, using the method of Bean (2007), *O. pinifolia* would key to indigenous based on the following criteria: non-adhesive terrestrial plant; indigenous in adjacent areas such as Java and related species indigenous in Australia. This occurrence thus represents the southern extent of the species' natural geographic range and represents a new record for Australia.

***Conservation status*:** *Oldenlandia pinifolia* is regarded as Vulnerable in Singapore (Chong *et al.* 2009, as *Hedyotis pinifolia*) and its conservation status in other countries is unknown. Despite lack of information on threats that may exist to this species in overseas countries, based on IUCN (2012) criteria *O. pinifolia* would likely be classified internationally as of Least Concern due to the species' large extent of occurrence and (presumed) area of occupancy, and the species apparent fecundity and abundance.

Within Australia, *O. pinifolia* is currently only known from Smith Point on Cobourg Peninsula, Northern Territory. As indicated above the species may occur at additional sites around the extensive coastline of Cobourg Peninsula where apparently suitable habitat would appear plentiful. However GGBNP has been moderately well surveyed for such a large and remote part of the NT, with 172 full-floristic biodiversity survey plots undertaken since 2005 (by Flora & Fauna Branch of the NT Department of Land Resource Management) which equates to a survey density of approximately 8.2 plots per 100 km^2. The majority of these sites were surveyed in an appropriate season for annual plants but of the 172 flora plots an unidentified *Oldenlandia* was recorded at only a single site (Cobourg_Co18) taken at Smith Point in April 2006. This record may represent *O. pinifolia*, as the only other *Oldenlandia* species known from the region are *O. galioides* and the introduced *O. corymbosa*,

Fig. 10. High density of ***Oldenlandia pinifolia*** seedlings in sandy soil of coastal plain, Cobourg Peninsula.

both readily recognised species. This scarcity of *Oldenlandia* records on Cobourg Peninsula suggests that *O. pinifolia* may indeed be restricted in extent.

Oldenlandia pinifolia was locally abundant at Smith Point in 2016–17 with many thousands of individuals (**Fig. 10**). It appears that the species is capable of producing abundant seed and young seedlings (at least in a good year) but presumably mass thinning occurs as the soil profile dries and only a small percentage of seedlings are recruited annually into the population.

Given its local abundance in Australia and its widespread distribution overseas *Oldenlandia pinifolia* is not likely to be at risk of extinction globally. As GGBNP is a conservation reserve there are no identifiable threatening processes that are likely to impact detrimentally on this species. However, due to its currently limited known distribution in Australia it would be classified as 'Data Deficient' under the *Territory Parks and Wildlife Conservation Act 2000* (Northern Territory Government 2017).

Acknowledgements:

Ian Cowie, Chief Botanist, NT Herbarium (DNA) is acknowledged for identifying my *Oldenlandia* specimens that this article is based on. Ying Luo is thanked for the photomicroscopy and Barbara Waterhouse for comment on the draft. I am grateful to the input from the anonymous referee. The Traditional Owners of Garig Gunak Barlu National Park are also acknowledged.

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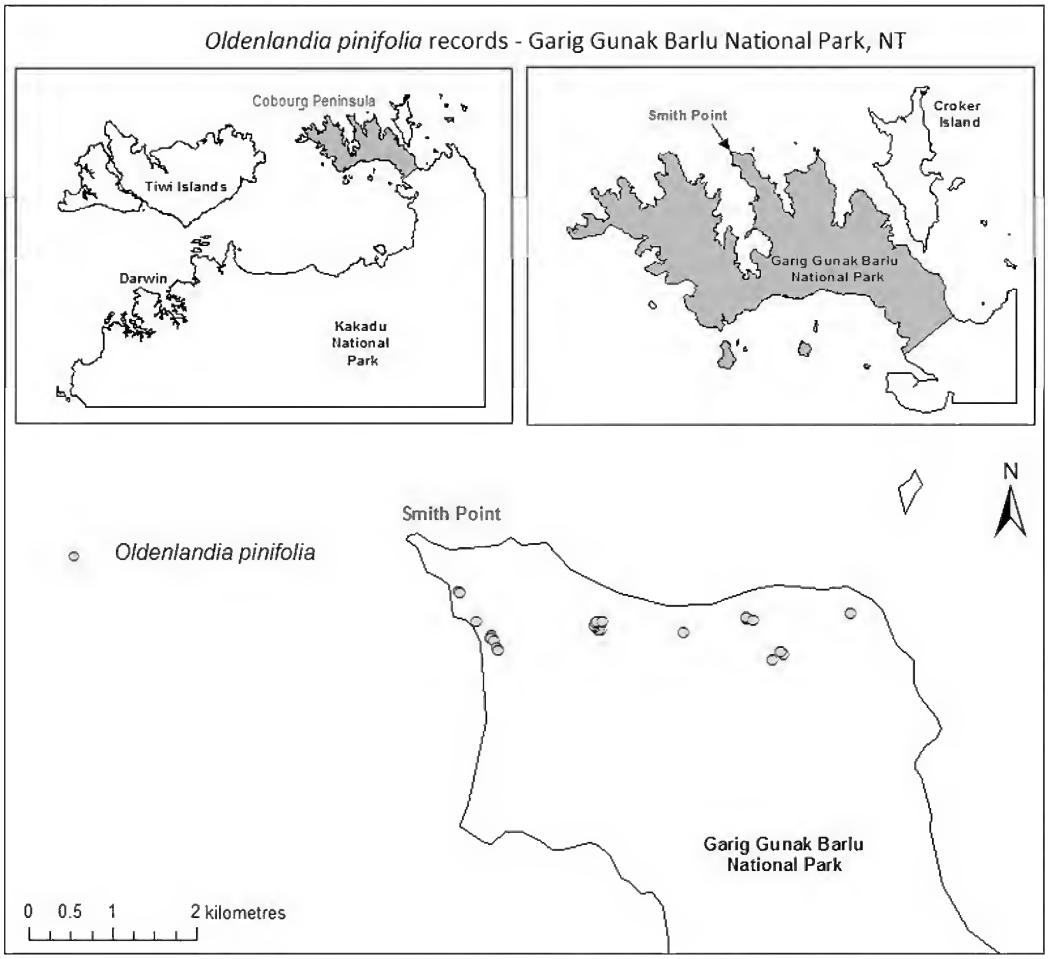

Map 1. Distribution of *Oldenlandia pinifolia* in Australia.

Olearia bella A.R.Bean & Jobson and *O. orientalis* A.R.Bean & Jobson (Asteraceae: Astereae), two new species from Queensland

A.R. Bean & P.C. Jobson

Summary

Bean, A.R. & Jobson, P.C. (2017). *Olearia bella* A.R.Bean & Jobson and *O. orientalis* A.R.Bean & Jobson (Asteraceae: Astereae), two new species from Queensland. ***Austrobaileya* 10(1): 102–112.** Two species of *Olearia* of restricted distribution in Queensland, *O. bella* and *O. orientalis*, are described as new. They are compared with their closest relatives, *O. ferresii* (F.Muell.) Benth. and *O. macdonnellensis* D.A.Cooke respectively. The new species are illustrated and their conservation status is assessed. A distribution map is provided for all four species, along with an identification key to Queensland *Olearia* species.

Key Words: Asteraceae, Astereae, *Olearia*, *Olearia bella*, *Olearia ferresii*, *Olearia macdonnellensis*, *Olearia orientalis*, Australia flora, Northern Territory flora, Queensland flora, new species, taxonomy, identification key, conservation status

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Introduction

The two species described here, *Olearia bella* A.R.Bean & Jobson and *O. orientalis* A.R.Bean & Jobson, are of restricted distribution in Queensland. They have, in the past, been referred to *O. ferresii* (F.Muell.) Benth. and *O. macdonnellensis* D.A.Cooke respectively. Closer examination of the taxa showed clearly that the Queensland populations are easily distinguishable from their named relative, and that they deserve specific rank. Full descriptions are provided for the two newly named species and the two previously named species, and the new species are illustrated. Cross *et al.* (2002) have shown that *Olearia* Moench is polyphyletic, and that the circumscription of the genus is very likely to change after further study. *O. ferresii* was included in Cross *et al.* (2002), with an unresolved position, while none of the other three taxa was included.

A key to the Queensland species of *Olearia* is provided.

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Materials and methods

This study is based on the morphological examination of specimens held at AD, BRI and NT. Measurements are taken from dried material except for floral parts, which were reconstituted with boiling water. The distribution map was compiled using DIVA-GIS Version 7.5.0, using geocodes given on the labels of herbarium specimens at BRI and NT. Northern Territory botanical districts follow Chippendale (1971).

A common abbreviation in the specimen citations is NP for National Park.

Taxonomy

Olearia bella A.R.Bean & Jobson **sp. nov.** with affinity to *O. ferresii* (F.Muell.) Benth. but differing by the dense eglandular hairs on stems, leaves and involucral bracts, non-glandular leaf surfaces, the more numerous involucral bracts, and mauve to purple ligules. **Typus:** Queensland. Warrego District: *c.* 15 km S of Quilpie, towards Eulo, 4 September 1990, *Peter G. Wilson 513 & R. Rowe* (holo: BRI; iso: NSW, PERTH).

Bushy shrub to 80 cm high. Stems terete, but with several longitudinal ribs; dense indumentum of patent eglandular hairs to 0.1–0.3 (–0.5) mm long, and a sparse covering of shorter glandular hairs; oil glands absent. Leaves alternate, decurrent, narrowly-lanceolate to linear, 75–115 × 8–15 mm (6.7–11.5 times longer than broad), sessile, oil glands absent; apex acute; margins entire or denticulate, with teeth 0.2–0.5 mm long; venation visible throughout, mostly penninerved, but parallel-veined near base, with three prominent veins at base continuing onto stem and forming stem-ribs; indumentum of patent eglandular hairs and sessile glands; sparse to moderately dense on upper surface, moderately dense to dense on lower surface. Capitula in terminal corymbose clusters of 2–5, pedunculate, radiate, 11–14 mm long, 14–23 mm diameter. Peduncles 10–60 mm long, with a few slender leaf-like bracts along their length. Involucral bracts 70–80, graduated in length, 4–5-seriate, outer surface with many multicellular, patent, eglandular hairs, margins entire, not membranous, apex acuminate; outer bracts linear to narrowly-lanceolate, *c.* 4 × 0.6 mm, inner bracts linear, 7.5–11 × 1–1.4 mm. Receptacle slightly convex, *c.* 5 mm across, with short irregular projections between the floret scars. Ray florets 14–18, uniseriate, female, corolla tube 4–4.5 mm long, glabrous; ligule 11–14 mm long, mauve to purple, apex minutely 3-lobed; stylar arms filiform, *c.* 1.5 mm long. Disc florets 80–100, bisexual, yellow, corolla tube 7.2–8.7 mm long, glabrous; corolla lobes 0.8–0.9 mm long, acute. Achenes narrowly obovoid, flattened, 3.2–3.5 mm long, with dense appressed white silky hairs throughout, carpopodium oblique. Pappus comprising 24–31 uniseriate barbellate bristles 7.5–9 mm long, and 2–7 bristles < half length of the rest; barbellae *c.* 0.05 mm long for most of bristle, but 0.1–0.15 mm long near apex. **Figs. 1–3.**

***Additional specimens examined*: Queensland.** Mitchell District: Near Glenara – Bramble Creek boundary, *c.* 30 km S of Yaraka, Aug 2012, *Silcock JLS1269 & McRae* (BRI); 7 km W of Milo Station, near entrance to Bat Cave, Dec 2013, *Silcock JLS1593* (BRI). Gregory South District: *c.* 2 km W of Nine Mile Tank, S of dog fence, Araluen, Aug 2011, *Silcock JLS1002* (BRI). Warrego District: Diamond Hill, Idalia NP, 113 km S of Blackall, Jun 1999, *Nicholls SN025* (BRI, CANB); Ranges N of Idalia homestead, Idalia NP, Jul 2010, *Silcock JSL632* (BRI).

***Distribution and habitat*:** *Olearia bella* is confined to a relatively small area of south-western Queensland, between Idalia NP and south of Quilpie, and west to Milo Station (**Map 1**). It inhabits stony slopes or 'breakaways' associated with tertiary plateaux or mesas, where there is a moderately dense tree cover, including *Eucalyptus thozetiana* (Maiden) R.T.Baker. The soil is skeletal.

***Phenology*:** Flowers are recorded from June to September; fruits are recorded from August and September.

***Affinities*:** *Olearia bella* is allied to *O. ferresii*, but differs by the decurrent leaf base, with three veins from the leaf continuing onto the stem and forming stem ribs (stem ribs not formed from decurrent leaf base for *O. ferresii*); oil glands absent from stems and leaves (present on stems and leaves for *O. ferresii*); involucral bracts 70–80 (40–60 for *O. ferresii*); ray florets 14–18, tube glabrous (ray florets 8–10, tube with sparse hairs at apex for *O. ferresii*); ligules mauve to purple (cream to white for *O. ferresii*); stems with dense indumentum of patent eglandular hairs (hairs predominantly glandular, rarely with short eglandular hairs for *O. ferresii*).

***Conservation status*:** The species is known from five locations, with a total of around 500 plants (J. Silcock pers. comm. Feb 2017). Using IUCN guidelines (IUCN 2012), a conservation status of **Vulnerable** is recommended (criterion D2).

***Etymology*:** From the Latin *bellus*, meaning 'pretty'. This refers to the flower heads which are relatively large and showy.

Olearia ferresii (F.Muell.) Benth., *Fl. Austral.* 3: 487 (1867); *Eurybia ferresii* F.Muell., *Fragm.* 3: 18 (1862); *Aster ferresii* (F.Muell.) F.Muell., *Fragm.* 5: 75 (1865). **Type:** Northern Territory. Brinkley's Bluff, Macdonnell Ranges, *s.dat.*, *J.M. Stuart s.n.* (holo: MEL 689422 [JSTOR image!]).

Bushy shrub to 1.5 m. Stems terete, but with several longitudinal ribs, to almost squarish; indumentum of minute patent glandular hairs,

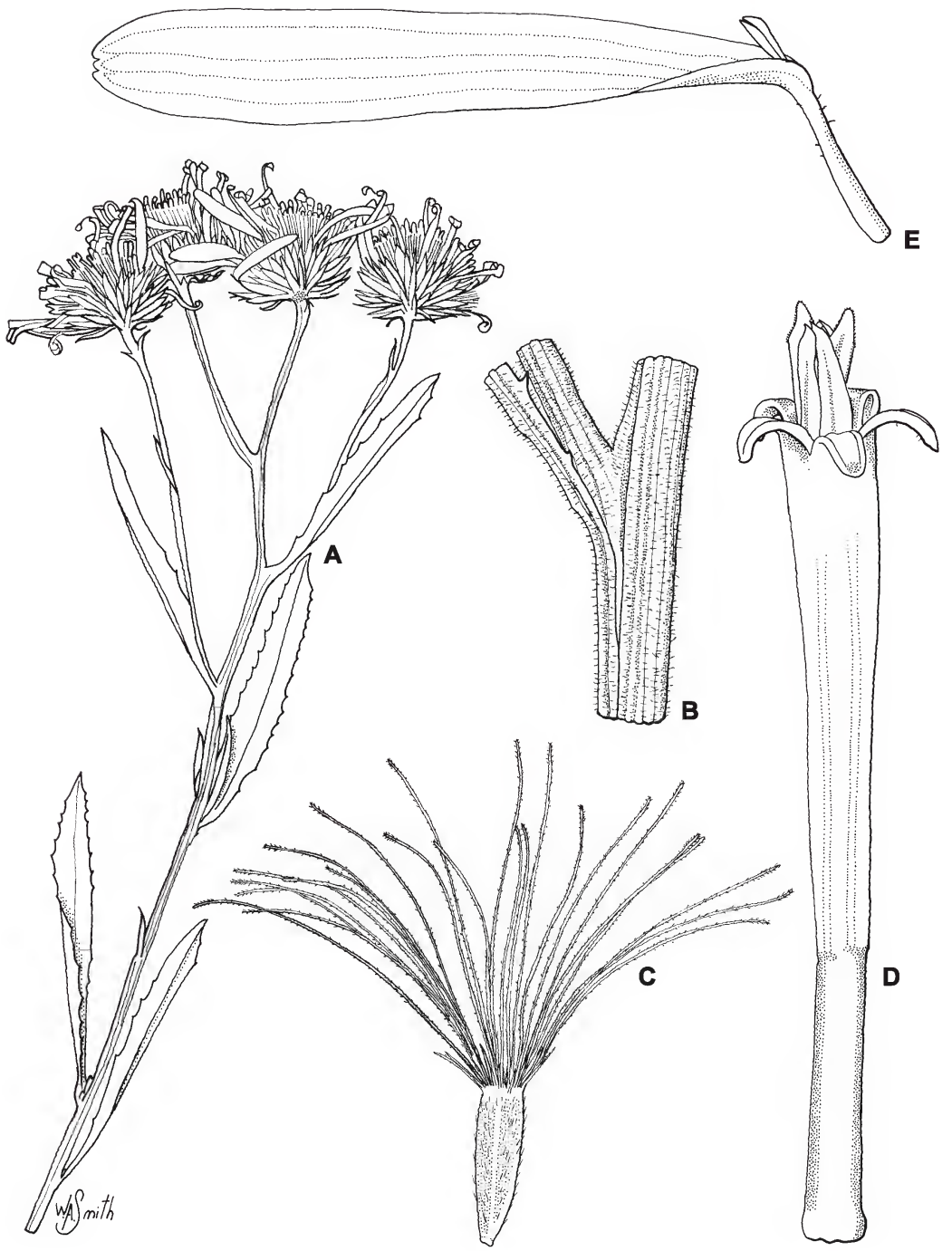

Fig. 1. ***Olearia bella***. A. flowering branchlet ×0.8. B. base of leaf showing decurrent leaf tissue ×4. C. achene and pappus ×6. D. disc floret ×14. E. ray floret ×6. A from *Wilson 513 & Rowe* (BRI); B–E from *Silcock JLS1002* (BRI). Del. W. Smith.

Fig. 2. ***Olearia bella***. Colony of plants in habitat, Araluen Station, Queensland, August 2011. Photo: T. Wattz.

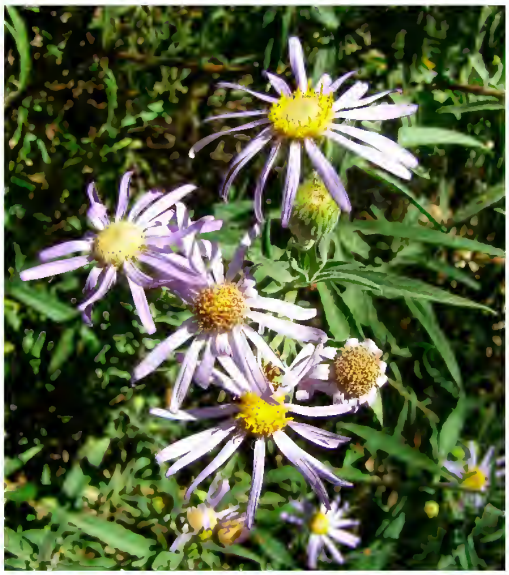

Fig. 3. ***Olearia bella***. Flowering plant, Araluen Station, Queensland, August 2011. Photo: T. Wattz.

becoming glabrous, or sometimes glabrous, or very rarely with erect eglandular hairs to 0.05 mm; oil glands often present on ribs of glabrous stems. Leaves alternate, narrowly-lanceolate to lanceolate, rarely oblanceolate, 40–80 × 6–22 mm (4.2–8.6 times longer than broad), base attenuate, oil glands present on lamina, apex acute; margins denticulate mostly in upper two-thirds, rarely with teeth in lower third, or rarely entire, teeth 0.05–0.8 mm long; venation visible throughout, mostly penninerved, upper leaf nerves looped and almost parallel to mid-rib; indumentum of sessile to erect glandular hairs, rarely with scurfy hairs on juvenile leaves, often becoming glabrous with age; sparse to moderately dense on both surfaces, appearing glabrous with age, older leaves occasionally with a pruinose bloom. Capitula in terminal corymbose clusters of 2–5, pedunculate, radiate, 15–20 mm long, 19–27 mm diameter. Peduncles 18–73 mm long, with a few slender leaf-like bracts along their length. Involucral bracts 40–60, graduated in length, 4–5-seriate, outer surface with sessile glandular hairs, margins entire but appearing dentate due to white, yellow or brown stiff erect to appressed hairs, not membranous, apex acuminate;

outer bracts linear to narrowly-lanceolate, 3.25–4.25 × 0.6–1.1, inner bracts lanceolate to narrowly-oblanceolate, 5–6.5 × 0.65–1.1 mm. Receptacle slightly convex, 5–5.5 mm wide with short irregular projections between the floret scars. Ray florets 8–10, uniseriate, female, corolla tube 5–7.5 mm long, glabrous except for very sparse hairs at apex, ligule 9–11 (–12) mm long, cream to white, apex minutely 3-lobed; stylar arms filiform, *c.* 1 mm long. Disc florets 90–110, bisexual, yellow, corolla tube 7.5–9 mm long, glabrous; corolla lobes 0.8–1.1 mm long, acute. Achenes narrowly obovoid, flattened, 3–4 mm long, with dense appressed white silky hairs throughout, often appearing ribbed on ventral face, carpopodium oblique. Pappus comprising *c.* 40 uniseriate barbellate bristles 7.25–9 mm long, and 2–4 bristles roughly half length of the rest; barbellae *c.* 0.05 mm long for most of bristle, but *c.* 0.1 mm long near apex and often darker coloured.

***Specimens examined*: Northern Territory.** Central Southern: Rowley Range, 68 km ENE of Docker River, Sep 2005, *Latz 21180* (NT); Farrar Spring, Eastern section of George Gill Range on N side, Sep 2012, *Duguid 1421* (NT); 20 km S of Mt Tate, Mereenie Gas Pipeline, Jun 2012, *Latz 27461 & Rilstone* (DNA, NT); Giles Yard Spring, Chewings Range, West MacDonnell NP, May 2002, *Barnetson 83* (NT). Central Northern: Dulcie Range, Arapunyah Station, Aug 1987, *Thomson 2035* (DNA). **South Australia.** North-western: SW of Mt Cuthbert, Musgrave Ranges, Jul 1982, *Conrick 796* (AD); 8 km NE of Yurangka, Western Musgrave Ranges, Oct 1998, *Lang et al. BS23-28943* (AD).

***Distribution and habitat*:** *Olearia ferresii* occurs from the Everard Range in South Australia, to Yuendumu in Northern Territory and eastwards to the Harts Range (**Map 1**). It grows in gullies or screes of quartzite, sandstone or granite hills and ranges, in open woodland with *Eucalyptus camaldulensis* Dehnh. or *Acacia aneura* F.Muell. ex Benth. shrubland with *Triodia*-dominated understorey.

***Phenology*:** Flowers and fruiting heads are recorded from May to October. All specimens examined had both flowers and mature achenes.

Olearia orientalis A.R.Bean & Jobson **sp. nov.** with affinity to *O. macdonnellensis* but differing by the solitary capitula, the shorter but more numerous ligules, the shorter corolla of the disc florets, the shorter capitula, and the very sparsely hairy achenes. **Typus:** Queensland. Port Curtis District: 3 km E of Glenavon homestead, Five Mile Creek headwaters, 1 March 1994, *P.I. Forster PIF15039 & A.R. Bean* (holo: BRI [2 sheets]; iso: AD, CANB, DNA, K, L, MEL, NSW, PE).

Olearia sp. (Glenavon P.I.Forster+ PIF15039); Henderson (2002).

Bushy shrub to 50–200 cm high. Stems angular to ribbed; young branchlets with an indumentum of scurfy eglandular hairs 0.1–0.2 mm long, often coated with resin, glandular hairs absent. Leaves alternate, obovate, 18–36 × 9–14 mm (1.8–2.6 times longer than broad), sessile or shortly petiolate, oil glands absent; apex mucronate or acute; margins sparsely denticulate, with 2–4 pairs of teeth 0.2–0.5 mm long; venation obscure to faintly visible, often more so on abaxial surface, venation penninerved with looped veins at apex; indumentum absent, but surface conspicuously resinous especially on younger leaves. Capitula terminal, solitary, pedunculate, radiate, 6–9 mm long, 8–11 mm diameter. Peduncles 12–55 mm long, with a few short antrorse bracts along their length, sometimes uncinate. Involucral bracts 42–52, graduated in length, outer surface glabrous, resinous, margins entire, not membranous, apex acute; outer bracts ovate to broadly-lanceolate, 1.5–2.5 × 0.8–1.2 mm, inner bracts lanceolate, 3.6–4.3 × 0.8–0.9 mm. Receptacle convex, 3.1–3.7 mm across, with short irregular projections between the floret scars. Ray florets 14–20, uniseriate, female, corolla tube *c.* 3 mm long, glabrous; ligule 3–6 mm long, white, apex minutely 3-lobed; stylar arms filiform, 0.6–0.9 mm long. Disc florets 16–26, bisexual, yellow, corolla tube 4–4.7 mm long, with scattered very short antrorse hairs midway along tube; corolla lobes 0.8–0.9 mm long, acute. Achenes narrowly obovoid, flattened, 2–2.8 mm long, with numerous longitudinal ribs or striae,

very sparse antrorse white hairs throughout, carpopodium not oblique. Pappus comprising 31–40 uniseriate barbellate bristles 4–4.7 mm long, and 2–7 bristles < half length of the rest; barbellae < 0.05 mm long for most of bristle, but slightly longer near apex. **Figs. 4 & 5.**

***Additional specimens examined*: Queensland.** Port Curtis District: Bukulla, *c.* 10 km NW of Marlborough, Jun 2004, *Hanger 20* (BRI); Marlborough, May 2010, *Hendry 744/1* (BRI); Mt Redcliffe, 6 km SW of Marlborough railway station, Oct 1991, *Batianoff 911021 & Franks* (AD, BRI, CANB, DNA, MEL, NSW); Gumigil Mining Lease, 18 km SSW of Marlborough

Fig. 4. ***Olearia orientalis***. A. flowering branchlet ×1.5. B. achene and pappus ×12. C. disc floret ×16. D. ray floret ×8. A, C–D from *Hendry 744/1* (BRI); B from *Forster PIF15039* & Bean (BRI). Del. W. Smith.

Fig. 5. ***Olearia orientalis***. Flowering plant, Glen Geddes, Queensland, July 1989. Photo: A.R. Bean.

township, Jul 2000, *Champion 1645 & Whereat* (BRI, NSW); 1 km W of Glen Geddes, Jan 1988, *Forster PIF3398* (BRI); Marlborough Nickel Project, off Coorumburra Road, section known as 'Magpie', Aug 1999, *Champion IGC1535 et al.* (BRI); lower slopes of Mt Bonnie Doon, *c.* 26 km W of Yaamba, Jun 2006, *Hendry & Hendry s.n.* (BRI [AQ737794]); 4 km W of Kunwarara, between Canoona & Princhester, track to microwave tower, Jun 2011, *Forster PIF38214* (BRI, MEL); Glen Geddes siding, forestry reserve, May 1998, *Batianoff 98057R & Ryan* (BRI, CANB, DNA, MEL, NSW); Glen Geddes, 2–3 km from Bruce Highway, Apr 2008, *Reeves 3465 & Batianoff* (BRI, E).

***Distribution and habitat*:** *Olearia orientalis* has a restricted distribution northwest of Rockhampton in Queensland (**Map 1**). It is confined to serpentinite hills and ridges, with shallow or skeletal soil, in woodland dominated by *Eucalyptus fibrosa* F.Muell. subsp. *fibrosa* and/or *Corymbia xanthope* (A.R.Bean & Brooker) K.D.Hill & L.A.S.Johnson.

***Phenology*:** Flowers are recorded for almost every month of the year, while fruits are recorded from March and October.

***Affinities*:** *Olearia orientalis* is similar in appearance to *O. macdonnellensis*, but differs by the solitary capitula (corymb of 2–5 capitula for *O. macdonnellensis*), 14–20 ray florets (6–8 for *O. macdonnellensis*), ligules 3–6 mm long (7–11 mm long for *O. macdonnellensis*), disc corolla 4–4.7 mm long (6–7 mm long for *O. macdonnellensis*), achenes almost glabrous (very dense antrorse hairs throughout for *O. macdonnellensis*) and capitula 6–9 mm long (10–12 mm long for *O. macdonnellensis*).

***Conservation status*:** *Olearia orientalis* is known from 13 subpopulations throughout its range, each of which is small and localised. The serpentinite rocks on which the species grows contain valuable minerals, and the area has numerous mines and more mines are anticipated. The extent of occurrence of this species is around 1800 km^2, while the estimated area of occupancy is *c.* 5 km^2. A conservation status of **Vulnerable** (criteria

C1, C2a(i), D2) is recommended based on the IUCN guidelines (IUCN 2012).

***Etymology*:** From the Latin *orientalis*, meaning 'eastern' or 'of the east'. This refers to the distribution of the species in eastern Australia.

Olearia macdonnellensis D.A.Cooke, *Muelleria* 6: 181 (1986). **Type:** Northern Territory. 1 km W of Ellery Creek Big Hole, 17 August 1983, *P.K. Latz 9636* (holo: NT; iso: AD, CANB, DNA).

Erect bushy shrub to 1.2 m. Stems angular to semi-terete, ribbed, red-brown; young branchlets with a dense to sparse indumentum of scurfy hairs often coated with resin (especially at growing tips), glandular hairs absent. Leaves alternate, broad elliptic, oblong, to broad ovate, 17–27 × 8–15 mm (1.8–2.1 times longer than broad), petiole 2.25 –6.25 mm long, oil glands absent, apex mucronate or acute; margins sparsely denticulate, with 3–5 pairs of teeth, 0.25–1 mm long; venation obscure to faintly visible, often more so on abaxial surface, venation penninerved with looped veins at apex; surface punctate, often covered in resin. Capitula in terminal corymbose clusters of 2–5, pedunculate, radiate, 10–12 mm long, 9–14 mm wide. Peduncles 7.5–24(–55) mm long, with 1–5 bracts along their length, bracts often uncinate. Involucral bracts 16–20, graduated in length, outer surface with occasional hairs in upper midrib, resinous, margins entire or coarsely erose-ciliate with occasional hairs, more towards the apex, margins membranous particularly in outer bracts, apex acute; outer bracts narrow lanceolate 2.75–5 × 0.6–0.8 mm, inner bracts linear-lanceolate, 7–8 × 0.9–1.25 mm. Receptacle convex, *c.* 2 mm across, with short irregular projections between the floret scars. Ray florets 6–8, uniseriate, female, corolla tube 3.5–4 mm long, glabrous except for rare obtuse hairs in upper portion; ligule 7–11 mm long, white or yellow, apex minutely 3-lobed; stylar arms filiform, 1.25–1.6 mm long. Disc florets 15–20, bisexual, yellow, corolla tube 6–7 mm long, with very sparse obtuse antrorse hairs midway along tube; corolla lobes 0.75–1 mm long, acute. Achenes narrowly obovoid, flattened or tetragonous, 2.25–4 mm long, with very dense antrorse white hairs throughout, occasionally appearing to present a marginal rib along one side, carpopodium oblique. Pappus comprising 20–32 uniseriate barbellate bristles 3.75–8.25 mm long with 2–4 bristles < 3/4 length of the rest; barbellae *c.* 0.05 mm long for most of bristle, barbellae consistent along length of bristle.

***Additional specimens examined*: Northern Territory.** Central Southern: 19 km E of Glenn Helen Resort, Aug 2004, *Albrecht 11008 & Latz* (DNA, NT); Gorge behind old Serpentine Chalet, Jul 1988, *Leach 2059 & Barritt* (AD, DNA, NT); 5 km E of Ellery Creek Big Hole, May 2000, *Latz 16156* (NT); Ranges S of Paddy's Plain, East MacDonnell Ranges, Sep 1989, *Soos 102* (NT).

***Distribution and habitat*:** *Olearia macdonnellensis* is endemic to the Northern Territory where it is restricted to the West MacDonnell Ranges between Glen Helen and Ellery Rockhole (**Map 1**). It inhabits rocky screes or creek gullies of either dolorite or quartzite, in open low eucalypt or mulga woodland.

***Phenology*:** Flowering is recorded from May to October, with an a seasonal flowering specimen from February; fruiting from June to October

***Notes*:** When Cooke (1986) described *Olearia macdonnellensis*, the material available to him was limited. With subsequent collections, it was noted that a number of measurements and descriptors did not match what was being observed and an expanded description has been presented here.

Key to Queensland species of *Olearia*

1 Stems and leaves with stellate hairs **2**
1. Stems and leaves without stellate hairs **7**

2 Leaves 5–8 mm wide, green on both sides; Stradbroke Island only . . . . . **O. hygrophila**
2. Leaves 9–35 mm wide, lower surface grey-green to white; mainland only **3**

3 Upper surface of fully expanded leaves glabrous or with a few scattered hairs **4**
3. Upper surface of fully expanded leaves moderately or densely stellate-hairy **5**

4 Leaf margins with 12–30 pairs of teeth; corymbose terminal conflorescences with more than 40 capitula; Border Ranges SE Qld . . . **O. heterocarpa**
4. Leaf margins entire; paniculate or corymbose conflorescences with (1–2)–20 capitula . . . . . **O. canescens** subsp. **discolor**

5 Stellate hairs on stems or leaves 0.15–0.25 mm across; involucres 3–4.5 mm long, 4–7 mm diameter; leaves entire . . . . . **O. canescens** subsp. **canescens**
5. Stellate hairs on stems or leaves 0.25–0.5 mm across; involucres 5–11 mm long, 10–18 mm diameter; leaves often lobed or toothed **6**

6 Indumentum of leaf underside very dense, obscuring surface at 10× magnification; fully developed leaves 9–19 mm wide; SE Qld . . . . . **O. gravis**
6. Indumentum of leaf underside moderately dense to dense, surface visible at 10× magnification; fully developed leaves 14–35 mm wide . . . . . **O. nernstii**[1]

7 Leaves and branchlets on new growth viscid **8**
7. Leaves and branchlets not viscid **10**

8 Leaves entire, elliptical; older leaves varnished, shiny; petiole distinct, 5–10 mm long . . . . . **O. elliptica** subsp. **elliptica**
8. Leaves toothed or denticulate, obovate to cuneate; older leaves often neither varnished nor shiny; petiole absent **9**

9 Leaves cuneate, 3.5–4.5 times longer than broad; involucres 14–16 mm long; achenes densely hairy; NW of Mitchell . . . . . **O. cuneifolia**
9. Leaves obovate, 1.8–2.6 times longer than broad; involucres 6–9 mm long; achenes sparsely hairy; NW of Rockhampton . . . . . **O. orientalis**

10 All leaves < 9 mm long **11**
10. Larger leaves on any given specimen > 9 mm long **14**

11 Leaves appressed to stems, in clusters of 3–6; involucral bracts with golden sessile glands along much of their length; SE Qld . . . . . **O. ramosissima**
11. Leaves spreading, usually solitary (occasionally clustered); golden glands absent from involucral bracts or confined to apical part **12**

12 Capitula solitary, terminal; involucres 6.5–9 mm long, 9–14 mm wide; pappus 7.5–8 mm long; S Qld . . . . . **O. pimeleoides**
12. Capitula terminal and axillary; involucres 3.5–5 mm long, 4–6 mm wide; pappus 3–4 mm long **13**

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[1] Integrades occur between this species and *O. gravis,* and some specimes are difficult to place.

13 Leaves obovate to broadly obovate, orange glands not prominent on underside; achenes of ray florets glabrous, those of disc florets densely glandular . . . . . **O. microphylla**
13. Leaves narrowly-elliptic, orange glands prominent on underside; all achenes densely silky hairy . . . . . **O. ramulosa** *sens. lat.*

14 Stems and leaves with stalked glandular hairs **15**
14. Stems and leaves lacking stalked glandular hairs **17**

15 Leaves broadly elliptic to broadly ovate; eglandular hairs equally as frequent as glandular hairs . . . . . **O. xerophila**
15. Leaves linear to narrowly-elliptic or oblanceolate; eglandular hairs much less frequent than glandular hairs **16**

16 Leaves 9–22 mm long; glandular hairs of varying length (0.05–0.2 mm long) abundant on leaves and stems; stems without ribs; W Qld. . . . . **O. stuartii**
16. Leaves 37–53 mm long; glandular hairs (all *c.* 0.05 mm long) sparse to dense on leaves and stems; stems with ribs formed by decurrent leaf midrib . . . . . **O. gordonii**

17 Leaves opposite; reticulate veins raised on upper surface **18**
17. Leaves alternate; reticulate veins not raised on upper surface **19**

18 Leaves 1–2(–8.5) mm wide, margins entire or obscurely toothed . . . . **O. rosmarinifolia**[2]
18. Leaves 10–21 mm wide, margins distinctly toothed . . . . . **O. oppositifolia**

19 Stems and leaves glabrous; leaves with prominent glands along margins; Girraween NP, SE Qld . . . . . **O. glandulosa**
19. Stems and leaves hairy; leaves without glands along margins **20**

20 Leaf and stem hairs completely appressed, individual hairs scarcely distinguishable; 'Scenic Rim', SE Qld . . . . . **O. cydoniifolia**
20. Hairs on leaves and stems not completely appressed; individual hairs readily distinguished; western and northern Qld. **21**

21 Hairs on leaves and stems erect, not woolly or silky; involucres 14–23 mm diameter; rays mauve to purple . . . . . **O. bella**
21. Stems and leaves with woolly or silky hairs; involucres 4–14 mm diameter; rays white . **22**

22 Hairs > 1 mm long, silky, ± straight; leaves elliptical; involucres 11–14 mm diameter; peduncles 50–180 mm long . . . . . **O. arguta** var. **lanata**
22. Hairs < 1 mm, woolly, crisped; leaves linear to oblanceolate; involucres 4–7 mm diameter; peduncles 1–4 mm long . . . . . **O. subspicata**

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[2] Mostly the leaves are 1–2 mm wide, but specimens from Mt Glorious are broader (up to 8.5 mm wide), and approach the narrower forms of *O. oppositifolia.*

Acknowledgements

We are grateful to Jennifer Silcock for her distributional and ecological notes on *O. bella*, to Tracy Wattz for the use of her photos of that species, and to Will Smith for the illustrations.

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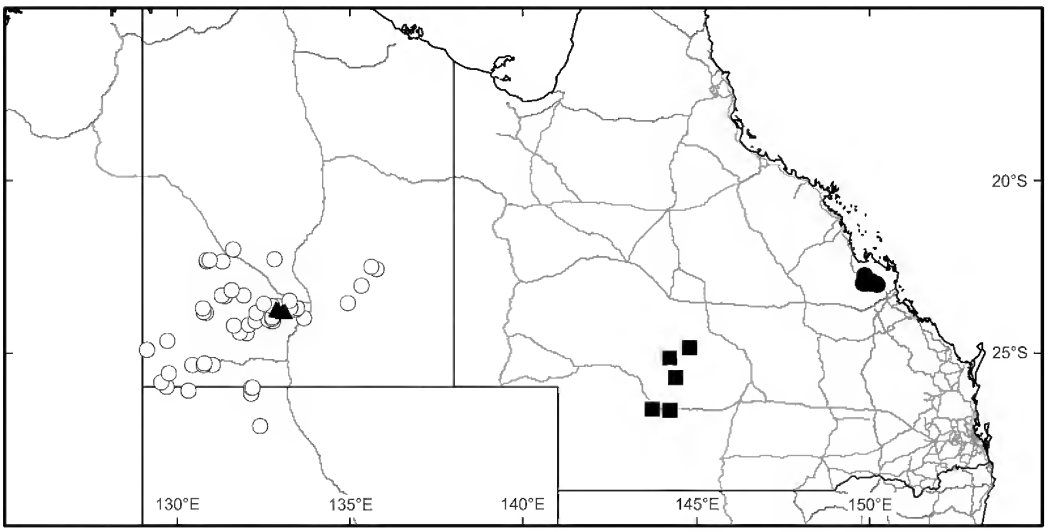

Map 1. Distribution of *Olearia* spp. *Olearia bella* ■, *O. ferresii* ○, *O. macdonnellensis* ▲ and *O. orientalis* ●

Hibiscus diversifolius subsp. *rivularis* (Bremek. & Oberm.) Exell (Malvaceae) in Australia

Mohamed O. Badry[1,2], Darren M. Crayn[3], & Jennifer A. Tate[1]

Summary

Badry, M.O., Crayn, D.M. & Tate, J.A. (2017). *Hibiscus diversifolius* subsp. *rivularis* (Bremek. & Oberm.) Exell (Malvaceae) in Australia. ***Austrobaileya* 10(1): 113–120**. *Hibiscus diversifolius* Jacq. is a widespread pantropical species found in Africa, Asia, Australia, and North and South America. In Australia, most populations are yellow-flowered, conforming to *H. diversifolius* subsp. *diversifolius*. However, a dark pink to maroon-flowered form previously recognized as a colour variant of subsp. *diversifolius* should be recognized as subsp. *rivularis*. After examining material from several herbaria, we find that *H. diversifolius* subsp. *rivularis* in Australia is restricted to the Atherton Tableland, north Queensland, and the remaining occurrences of the species along the east coast and in Western Australia are subsp. *diversifolius*. Outside Australia, subsp. *rivularis* is found in Africa and Brazil and the first Australian record dates to 1947. Based on this we suggest that its presence in Australia is a result of naturalisation due to one or more introductions from Africa via service personnel and/or equipment returning from the Middle East during and after World War II. A full description of *H. diversifolius* subsp. *rivularis* is provided, as are the key characters used to distinguish the two subspecies as they occur in Australia.

Key Words: Malvaceae, *Hibiscus*, *Hibiscus diversifolius* subsp. *rivularis*, Australia flora, Queensland flora, leaf cuticle surface, seed coat, naturalised status

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Introduction

Hibiscus Section *Furcaria* DC. is a diverse, but natural group, containing *c.* 109 taxa (Wilson 2006). In Australia, the most recent treatment of Sect. *Furcaria* recognized 32 species, 31 indigenous species (of which 29 are endemic) and one (*H. sabdariffa* L.) naturalised (Wilson & Craven 1995; Craven *et al.* 2003, 2016). Within Sect. *Furcaria*, *H. diversifolius* Jacq. appears to be the most widespread species, being found in Africa, Madagascar, Asia, Australia, the Pacific islands (including New Zealand), and North and South America (Wilson 1993; Badry *et al.* 2015), and contains two subspecies: yellow-flowered *H. diversifolius* subsp. *diversifolius* and purple-flowered *H. diversifolius* Jacq. subsp. *rivularis* (Bremek. & Oberm.) Exell. (Edmonds 1991; Wilson 1999).

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In Australia, *H. diversifolius* occurs primarily on the east coast from Queensland to New South Wales, and in south-western Western Australia. Only the pantropical yellow-flowered *H. diversifolius* subsp. *diversifolius* has been recognized as occurring in Australia (Wilson 1974, 1993). However, there has been some uncertainty regarding the validity of the dark pink to maroon-flowered form of *H. diversifolius* in Australia. Although it was recognized as occurring on the Atherton Tableland, in north Queensland, it was not referred to the *H. diversifolius* subsp. *rivularis* of Africa and Brazil, and was therefore regarded as a colour variant of subsp. *diversifolius* (Wilson 1994, 2006; Wilson & Craven 1995). After examining several herbarium specimens of the purple-flowered form and comparing them to specimens of *H. diversifolius* subsp. *diversifolius*, we determined that the plants previously collected from the Atherton

Tableland are morphologically distinct from subsp. *diversifolius* and can be accommodated within *H. diversifolius* subsp. *rivularis*.

The objective of this paper is to provide a description of *Hibiscus diversifolius* subsp. *rivularis* from Queensland so that it can be formally recognised for Australia and to provide distinguishing morphological characteristics to separate the two subspecies of *H. diversifolius* in Australia.

Materials and methods

Herbarium specimens from BRI, CANB, CBG, CNS, MPN, NSW and PERTH (herbarium acronyms as per Index Herbariorum: A Global Directory of Public Herbaria and Associated Staff 2016) were examined, together with field collections. The measurements for floral parts were based on material reconstituted with hot water, while other plant parts were measured from dried materials using a stereomicroscope (SM) Olympus SZ×7 with an Olympus SC100 digital camera (Olympus America Inc., USA) at the Dame Ella Campbell Herbarium (MPN), Massey University, New Zealand. Leaf surface patterns, stomata, and the seed coat were also studied by scanning electron microscopy (SEM). Samples of dry leaves and mature seeds were mounted onto clean stubs using double-sided adhesive tape, coated with gold using a BAL-TEC SCD 050 ion sputtering device, and examined and photographed using a FEI Quanta 200 Environmental Scanning Electron Microscope (at an accelerating voltage of 20 kV) at the Manawatu Microscopy and Imaging Centre (MMIC), Massey University, New Zealand.

Taxonomy

Hibiscus diversifolius subsp. **rivularis** (Bremek. & Oberm.) Exell., *Fl. Zambesiaca* 1(2): 444 (1961); *H. rivularis* Bremek. & Oberm., *Ann. Transvaal Mus.* 16: 424 (1935). **Type:** Botswana: Chobe River Kabulabula, Bechuanaland Port., July 1930, *Van Son s.n.* (holo: PRE 28936 *n.v.*; iso: BM).

Perennial shrub much-branched from the base, 1.5–3 (4) m high. **Stems** terete, erect, branched, stout, and woody at the base, prominently aculeate at the plant base, with or without lines of pubescence, the stems above aculeate, with dense and fine simple and stellate trichomes. **Stipules** linear, 3.3–10 mm long, caducous, pubescent (simple trichomes). **Leaves** heteroblastic, alternate, petiolate. **Petioles** 0.3–11.2 cm long with dense simple, bifurcate and stellate trichomes on the adaxial side, 1–2 lines of fine to stout sharp conical prickles on the abaxial side. **Lamina** 1.6–12.5 cm × 0.4–14.4 cm, with simple and bifurcate trichomes on the adaxial surface and simple, bifurcate and stellate trichomes on the abaxial surface, with different forms: lower leaves near base of the plant with laminae broadly ovate, entire to shallowly-palmately 3–5-lobed, base rounded to truncate, margins ± dentate to crenate, apex acute or obtuse; at the mid-plant, laminae broadly ovate, triangular, or suborbicular, shallowly-palmately 3–5-lobed, base cordate, rounded or truncate, margins dentate or irregularly serrate, apex acute or acuminate; upper leaves with laminae lanceolate, ovate or elliptic, base cuneate or truncate, margins finely to coarsely dentate, apex acuminate or acute; uppermost leaves on flowering branches very reduced into narrowly elliptic bracts with finely dentate margins, base cuneate. **Foliar nectary** 1.2–3.3 mm long, conspicuous, narrowly elliptic, on the base of the midrib on the abaxial surface. **Flowers** 8–9 cm diameter, in terminal racemes, subsessile, pedunculate. **Peduncle** short, 1.4–3.2 mm long, densely stellate-pubescent. **Pedicel** 1.4–4.2 mm long, the indumentum dissimilar to that of the peduncle (densely hispid, with long simple trichomes mixed with fine conical prickles). **Epicalyx** segments 8–10, subulate, 4.5–14.5 mm long, slightly connate at the calyx base, hispid. **Calyx** 11.8–20.4 mm long, densely covered with long stiff bristles, lobes 7.5–15.2 mm × 4.3–8.5 mm, narrowly triangular or lanceolate, apex acute, having a prominent thickened midrib and two thickened marginal ribs; calyx nectary ± conspicuous, narrowly elliptic, 0.9–1.9 mm long on the midrib. **Corolla** of five petals 37.1–57.7 mm × 21.4–37.8 mm, shortly connate at the base, obovate, dark pink to maroon, deep maroon

Fig. 1. ***Hibiscus diversifolius*** subsp. ***rivularis.*** Fertile cultivated specimen (*Whitten s.n.*, BRI [AQ45592]). Photo: P. Joshi.

Fig. 2. ***Hibiscus diversifolius*** subsp. ***rivularis*****.** A. vegetative part of the plant with a close-up view of an open flower. B. flower and buds viewed from side with floral parts as indicated. C. view of an open fruit showing the seeds. D. enlarged epicalyx segment. A–C from *Jago 7798* (CNS); D from *Crayn 1384 & Gagul* (MPN). Photos A–C: R.L. Jago, D: M.O. Badry.

in the center, pubescent with flagellate non-glandular trichomes, apex rounded to retuse; claw margins ciliate, with dense unicellular trichomes. **Stamens** numerous, staminal tube 16.4–19.1 mm long, dark red-purple, adnate to the petals at the base, with thin-walled simple trichomes at the connection point between the petals and the staminal tube, otherwise glabrous; filaments 1.4–2.7 mm long. **Styles** five, basally connate and free at the tip, exserted beyond the staminal tube. **Ovary** syncarpous, superior, 5-locular, ovules 2 or more per locule. **Capsules** 11.2–22.8 mm long × 9.5–18.3 mm diameter, ovoid, acute, pointed, covered with dense, long, stiff appressed trichomes. **Seeds** ovoid-reniform in outline, 3.7–4.3 mm × 2.6–3.2 mm, dark brown, double reticulate, puberulent, hilum glabrous (**Figs. 1–3**).

Additional selected specimens examined **(*H. diversifolius*** subsp. ***rivularis*****): Australia. Queensland.** Cook District: Lake Barrine, Eacham, Jan 1947, *Flecker CAIRNS 10554* (CNS); Lake Barrine, Atherton Tableland, Sep 1997, *Cooper & Cooper 1154* (CNS); Scenic Reserve 440, Lake Euramoo, Atherton Tableland, Aug 1967, *Brass 33650* (CNS); *ibid.*, Jul 1970, *Kershaw & James ANU10025* (CANB); *ibid.*, Aug 1970, *Kershaw s.n.* (CNS 32809, 32810.2); *ibid.*, Jul 1992, *Gray 5443* (CNS); Toohey Creek, near Gadgarra, Atherton Tableland, Mar 1995, *Jensen 162* (CNS); Euramoo Swamp, swamp edge next to pump shed below lookout, Nov 2015, *Crayn 1384 & Gagul* (MPN). Moreton District: cult. Mt Coot-tha Botanic Gardens O24/25, Oct 1984, *Witten s.n.* (BRI [AQ455292]).

Selected specimens examined **(*H. diversifolius*** subsp. ***diversifolius*****): Egypt.** Qena Governorate: El Mahroosa, Kream Island, Nakada, 271 km from Aswan Reservoir and 20.2 km S of Qena City, Dec 2010, *Badry s.n.* (South Valley University Herbarium). Dandara: El Jebbail, Dandara Island, Dec 2013/May

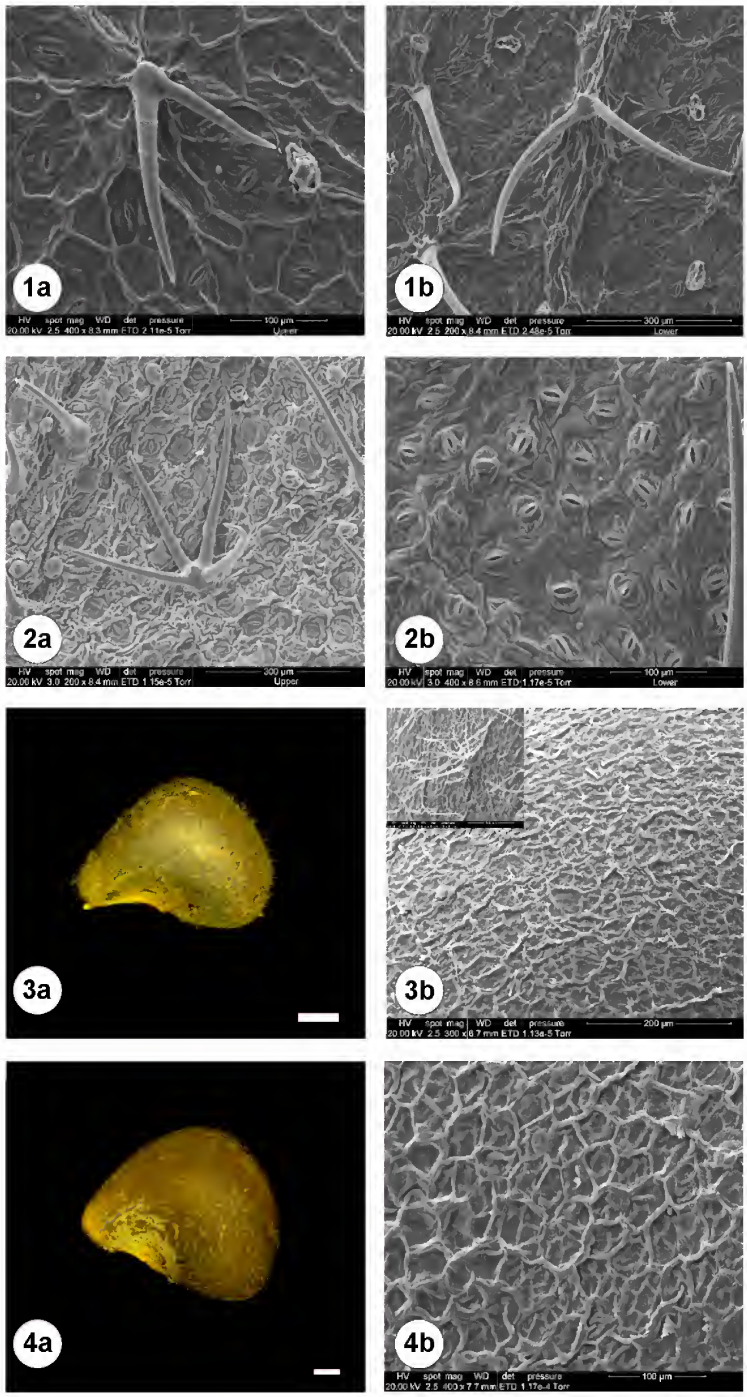

Fig. 3. Comparison of leaf and seed microfeatures for ***Hibiscus diversifolius*** subsp. ***rivularis*** (1, 3) and subsp. ***diversifolius*** (2, 4). (1, 2) SEM micrographs of leaf surface patterns (a: adaxial surface, b: abaxial surface); (3, 4) Seed micrographs (a: SEM of seed shape outline, b: SEM of seed coat sculpture). 1 & 3 from *Crayn 1384 & Gagul* (MPN); 2 & 4 from *Lepschi & Lally 2569* (CANB).

2014, *Badry s.n.* (MPN 49882, South Valley University Herbarium). **Papua New Guinea.** Gulf Province: Near Malalaua, Mar 1966, *Craven 930* (CANB). **Australia. Western Australia.** Avon District: Junction of Victor Road & Glen Road, Darlington, Perth, Feb 1996, *Lepschi & Lally 2505* (PERTH); Nyaania Brook, S end of Newman Road, Darlington, Perth, Apr 1996, *Lepschi & Lally 2569* (PERTH); In bed of Nyaania Creek, corner of Glen & Victor Roads, Darlington, Jan 1997, *Hussey s.n.* (PERTH 4609115). Darling District: Bank of Swan River at Maylands, Nov 1996, *Elliott s.n.* (PERTH 2246724); Swan River foreshore, N of St Anne's Hospital, Maylands, Dec 1983, *Keighery 6367* (PERTH); Swan River near junction of Abernethy Road & Great Eastern Highway, Belmont, Perth, Oct 1995, *Lepschi & Lally 2100* (PERTH); *ibid.*, Jan 1996, *Lepschi 2483* (PERTH); Drain between Melville Bowling Club and Swan River, Applecross, Feb 1997, *Brims 317* (PERTH); Swan River, Maylands, Nov 2009, *Thiele 3939* (PERTH). **Queensland.** Wide Bay District: Great Sandy NP, Fraser Island, Ocean Lake, Southern End, 4 km NW of Orchid Beach, Nov 2002, *Forster PIF29057* (BRI); Great Sandy NP, Fraser Island, northern side of Wathumba Swamp, 6.5 km WNW of Orchid Beach, Sep 2004, *Forster PIF30262 & Leiper* (BRI); Ocean Park Estate, Dundowran, Nov 1991, *Forster PIF9187* (BRI). Moreton District: End of Wallaby Way, Pimpama, May 2003, *Bean 20425* (BRI); Roadside at Jacobs Well Area, Sep 1976, *Elsol & Dowling 39* (BRI); Sunscape Drive, Eagleby, Aug 2003, *Bean 20669* (BRI); North Stradbroke Island, 18 Mile Swamp, Sep 2001, *Stephens 34 & Daniel* (BRI); *ibid.*, Oct 2001, *Stephens & Daniel* (BRI). **New South Wales.** North Coast District: 0.7 km S of Broadwater on Pacific Highway, Nov 2005, *Johnstone 1607* (CANB).

***Distribution and habitat*:** In Australia *Hibiscus diversifolius* subsp. *rivularis* is a long-lived perennial of moist habitats, found on the margins of freshwater bodies on the Atherton Tableland, north Queensland in plant communities typically dominated by *Phragmites* species (Poaceae).

Hibiscus diversifolius subsp. *rivularis* is usually confined to tropical Africa where it is known from the Democratic Republic of Congo, Angola, Tanzania, Uganda, Burundi, Rwanda, Malawi, Zambia, Zimbabwe, Mozambique, Namibia's Caprivi Strip and Botswana (Bechuanaland Protectorate). It is also recorded from Brazil (Wilson 1999; Esteves *et al.* 2014).

***Notes*:** The two subspecies of *Hibiscus diversifolius* may be distinguished in Australia at the vegetative, flowering and fruiting stages (**Table 1**). In Africa it is easy to distinguish between the subspecies of *H. diversifolius* where the yellow-flowered *H. diversifolius* subsp. *diversifolius* is also distinctive by the longitudinal line or lines of pubescence on its stems. This distinction, however, does not apply to the Australian material, especially at the vegetative stage, because uniformly pubescent stems occur on both yellow- and maroon-flowered specimens. The use of leaf micro-morphology along with seed coat sculpturing provides new significant characters that help to distinguish the subspecies in Australia **(Table 1, Fig. 3)**.

In 1943 the headquarters of the Australian Army in north Queensland was transferred from Townsville to the Atherton Tableland. Further developments saw the facilities become a major rehabilitation area and jungle warfare training ground for troops of the 6th, 7th and 9th Australian Divisions returning from service in North Africa during World War II (Pearce 2009). The oldest known herbarium specimen examined in this study was collected in 1947 from Lake Eacham. Thus, it seems possible that the subspecies was introduced from Africa via service personnel and/or equipment returning from the Middle East and that the species then became established and naturalised in the area.

Acknowledgments

We would like to express our deep gratitude to the directors of BRI, CANB, CBG, CNS, NSW and PERTH for the loan of specimens. Sincere thanks to Dr. Prashant Joshi, Massey University, New Zealand for his photographic image of the herbarium specimen and Dr. Gordon Guymer (BRI) for allowing its inclusion; Frank Zich, Australian Tropical Herbarium (CNS) for encouraging this manuscript, and Robert L. Jago of Cairns, for allowing us to use his field images. The Manawatu Microscopy and Imaging Centre (MMIC) staff at Massey University, New Zealand are gratefully acknowledged for their skillful technical help and SEM images.

Table 1. Distinguishing morphological characters of the two subspecies of *H. diversifolius* in Australia

Character		*H. diversifolius* subsp. *rivularis*	*H. diversifolius* subsp. *diversifolius*
Leaf shape			
Mid-stem leaves		Shallowly palmately 3–5-lobed	± deeply-palmately 3–5-lobed
Uppermost leaves		Narrowly-elliptic bracts	Reduced to narrowly-lanceolate or linear bracts
Leaf cuticle surface			
Adaxial surface	Cuticular surface	Reticulate, relief of cell wall boundaries ± striated. (**Fig. 3: 1a**)	Ruminate, relief of cell wall boundaries striated. (**Fig. 3: 2a**)
Abaxial surface	Stomata orientation	Same level as epidermal cells	Raised above the epidermal surface
	Cuticular surface	Ruminate, relief of cell wall boundaries smooth (**Fig. 3: 1b**).	Ruminate, relief of cell wall boundaries striated (**Fig. 3: 2b**)
Petal colour		Dark pink to maroon, deep maroon in the center (**Fig. 2A**)	Lemon-yellow, with a dark purplish basal blotch
Seed vestiture		Puberulent (**Fig. 3: 3a, b**)	Glabrous (**Fig. 3: 4a, b**)
Seed surface patterns			
Anticlinal cell walls		Boundaries raised-channeled, straight to slightly sinuous and thick with ruptured ridges	Boundaries raised, straight to slightly sinuous and thick with definite ridges
Periclinal cell walls		Thick, flat and channeled (**Fig. 3: 3b**)	Thick, flat to slightly concave (**Fig. 3: 4b**)

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Gymnogaster boletoides J.W. Cribb (Boletaceae, Boletales), a striking Australian secotioid bolete

Matteo Gelardi[1], Nigel Fechner[2*], Roy E. Halling[3], Federica Costanzo[1]

Summary

Gelardi, M., Fechner, N., Halling, R.E. & Costanzo, F. (2017). *Gymnogaster boletoides* J.W. Cribb (Boletaceae, Boletales), a striking Australian secotioid bolete. ***Austrobaileya* 10(1): 121–129.** The austral secotioid species *Gymnogaster boletoides* J.W. Cribb has been reported from various localities in southern Queensland, New South Wales, Victoria and Western Australia. A detailed, modern description of the species including macro- and micromorphological characters is provided, accompanied by colour images taken *in situ;* photomicrographs; and line drawings of the main anatomical features. Comparative assessments of morphologically closely allied species are also presented.

Key Words: Boletales, Boletaceae, *Gymnogaster boletoides*, Australia fungi, Queensland fungi, secotioid fungi, taxonomy

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Introduction

The taxonomic placement of the Australian secotioid bolete *Gymnogaster boletoides* J.W.Cribb has long been uncertain and the species has been placed in either the Secotiaceae Tul. & C. Tul. (Cribb 1956) or the Agaricaceae Chevall. (Kirk *et al.* 2008). However, molecular analysis carried out by Halling *et al.* (2012) clearly demonstrated that the species belongs to the family Boletaceae Chevall. and clusters in a separate, independent lineage with high phylogenetic confidence (Tedersoo & Smith 2013; Wu *et al.* 2014, 2016b; Zhao *et al.* 2014, 2015; Smith *et al.* 2015).

Intensive mycological field research carried out by Roy Halling (REH) and Nigel Fechner in eastern and south-eastern Australia over the years 2005–2015 resulted in several collections of *Gymnogaster boletoides* **(Figs. 1–6)**. Two additional samples were found by REH and Matteo Gelardi during the forays of the combined annual meeting of the Australasian Mycological Society, and the Queensland Fungi Festival held in Brisbane in late April 2014. Specimens of *G. boletoides* examined for this paper constitute a representative sample of the collections held in the Queensland Herbarium, one of which was gathered on Mt Glorious, the type locality where Joan Cribb first collected the species in 1956.

Materials and methods

Specimens examined were collected at different localities in Queensland, Australia, dried on a commercial portable food dehydrator and deposited in BRI, NY (Thiers 2015) and the personal herbarium of Matteo Gelardi. Herbarium collections are cited for those from which morphological features were examined. Author citations follow the *Index Fungorum, Authors of Fungal Names* (www.indexfungorum.org/authorsoffungalnames.htm).

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Fig. 1. ***Gymnogaster boletoides.*** Basidiomes *in situ* (*Halling et al. MG605*, BRI). Scale bar = 10 mm. Photo: M. Gelardi.

Fig. 2. ***Gymnogaster boletoides.*** Habit. (*Halling 9455*, BRI). Scale bar = 10 mm. Photo: R.E. Halling.

Macroscopic descriptions, habitat notations and associated plant communities were based upon detailed field notes of fresh basidiomes. Colours were recorded under daylight and described in general terms only. Micromorphological features were observed from dried material; sections were either rehydrated in water, 5% potassium hydroxide (KOH) or in ammoniacal Congo Red. Observation of structures and measurements of anatomical features were performed by mounting preparations in ammoniacal Congo Red. Colours and amount of pigmentation were described after examination in water and 5% KOH. Measurements were made at 1000× with a calibrated ocular micrometer (Nikon Eclipse E200 optical light microscope). Spores were measured from the hymenophore of mature basidiomes. Dimensions are given as (minimum–)a–b(–maximum), where the range a–b contains a minimum of 90% of the measured values, Q = length/width ratio with minimum and maximum values in parentheses, Qm = average quotient (length/width ratio) ± standard deviation, while average spore volume was estimated as a rotation ellipsoid [V= 4/3*(length/2)*((width /2)*width) *π/2 ± standard deviation]. The notation [n/m/p] indicates that measurements were made on "n" randomly selected spores from "m" basidiomes of "p" collections. Metachromatic, cyanophilic and iodine reactions were tested by staining the spores in Brilliant Cresyl blue, Cotton blue and Melzer's reagent respectively. Line-drawings of microstructures were made free hand from rehydrated material and based on photomicrographs.

Commonly used abbreviations in the specimen citation include NP for National Park.

Taxonomy

Gymnogaster boletoides J.W. Cribb, *Pap. Dept. Bot. Univ. Queensland* 3(13): 110 (1956). **Type:** Queensland. Moreton District: Mt. Glorious, 19 February 1955, *J.W. Cribb s.n.* (holo: BRI [BRIP10509]). *Mycobank number*: MB 298018.

***Illustrations*:** Cribb (1956: 111, figs 1–6).

Basidiomes secotioid, epigeous, 1–3.5 cm high, 0.7–5 cm broad, with hymenophore (fertile portion) surrounding percurrent stipe columella, ovoid, subglobose to elongate in outline or irregularly shaped, sometimes barely pileate, stipitate, evelate. *Pileus* a small apical, appressed disc, depressed, 4–8 mm broad, sometimes absent; surface of the disc matt, dry, very finely tomentose, dark brown to reddish-brown or orangish-brown, not cracked. *Hymenophore* completely

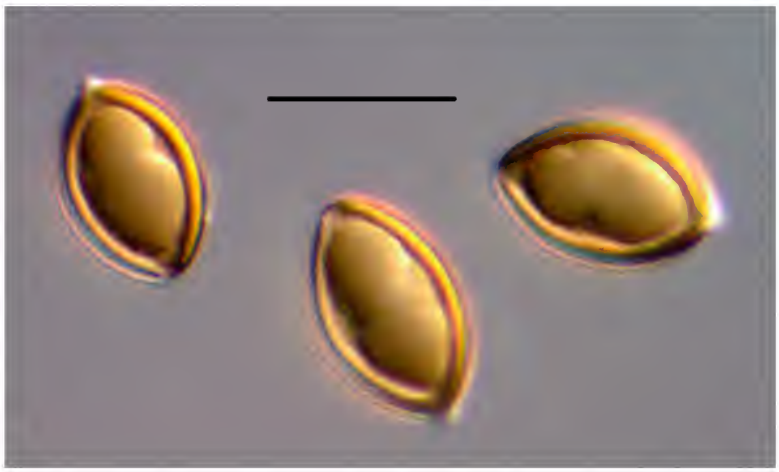

Fig. 3. ***Gymnogaster boletoides.*** Spores in KOH, showing thin wall (germ pore) at apex (*Halling 9800 & Fechner*, BRI). Scale bar = 10 μm. Photo: R.E. Halling.

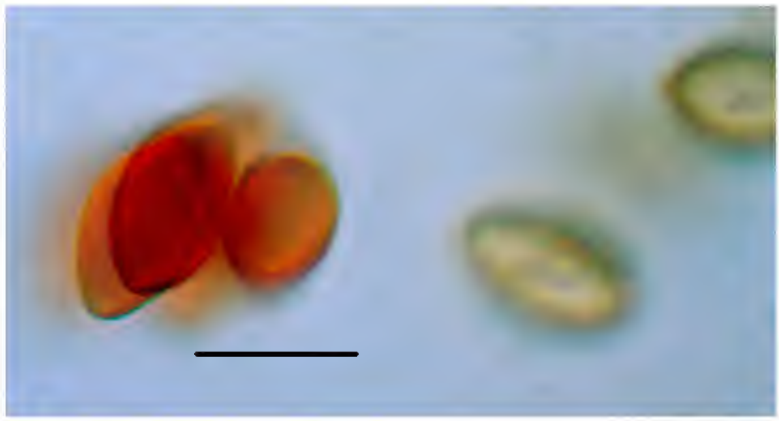

Fig. 4. ***Gymnogaster boletoides.*** Dextrinoid spores (*Halling 9800 & Fechner*, BRI). Scale bar = 10 μm. Photo: R.E. Halling.

and permanently exposed, *Morchella*-like, moderately fleshy, firm but progressively softer with age, slightly subdecurrent, undulate-loculate, consisting of labyrinthine to irregularly arranged, folded chambers tending to radiate out from the columella; surface and inner portions whitish with some brownish red stains at first then grayish-yellow, later bright lemon yellow to olive-yellow with scattered rusty brown spots and finally dull yellowish-brown, immediately staining dark blue on handling and finally fading to sordid brown. *Stipe* 0.5–1.5 × 0.1–0.8 cm, reduced, central, straight, cylindrical but tapered towards the base, protruding within the hymenophore as a columella, not or only faintly rooting; surface short sulcate at apex, dry, smooth to subpruinose, bright lemon yellow to orange–yellow at apex, rhubarb red elsewhere and progressively darker downwards, staining blue when pressed. *Columella* present, usually columnar and percurrent (not percurrent but dendroid with scattered, thin branches extending into the fertile hymenophore in collection *Gelardi et al. MG607*), context evenly whitish to

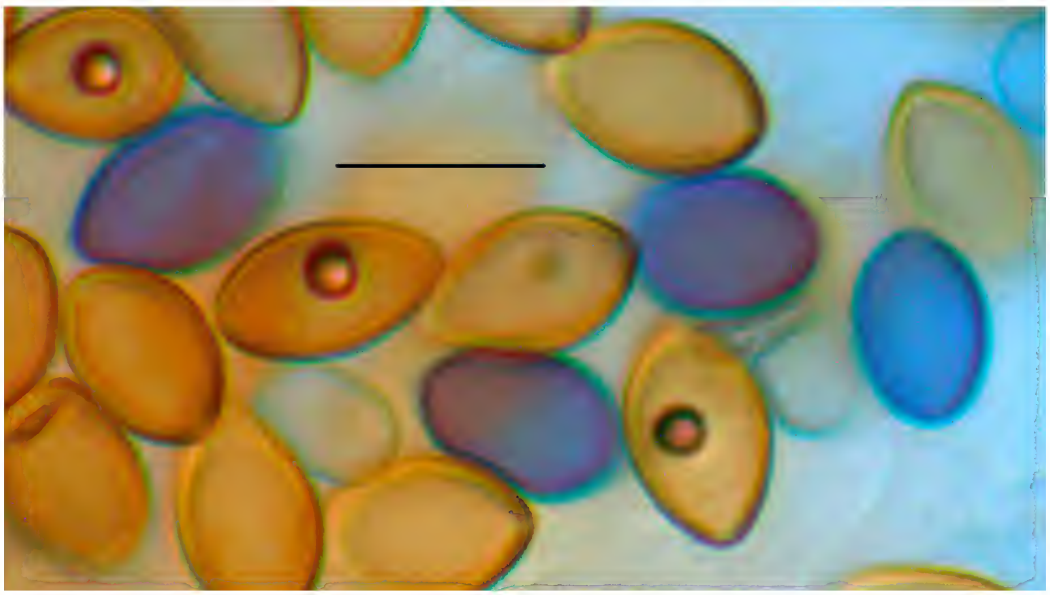

Fig. 5. *Gymnogaster boletoides.* Cyanophilic spores (*Halling 9800 & Fechner*, BRI). Scale bar = 10 µm. Photo: R.E. Halling.

yellowish, sometimes whitish only in the peripheral zones and rhubarb red inwards, staining blue on exposure. *Stipe context* solid but at times becoming hollow, whitish to rhubarb red or purple–red and gradually darker downwards, staining blue throughout when bruised.

Odour faint to sometimes pungent, agreeable. *Taste* mild. *Spore print* not obtained. *Basidiospores* [66/3/2] (10.0–)11.3–13.1(–14.0) × (6.7–)7.1–8.1(–8.6) µm, Q = (1.22–)1.36–1.80(–1.84), Qm = 1.60 ± 0.11, Vm = 370 ± 68 µm³ (n = 66 from the hymenophore of mature specimens) (several anomalous spores originating from 1-spored basidia have been observed in collection *Gelardi et al. MG607*, with size up to 26.0 × 13.2 µm!), bilaterally symmetric in all views, amygdaliform to citriform or rarely subglobose, apex rounded to sometimes pointed and with a thin germ pore–like region, smooth, with a pronounced, prominent apiculus and without suprahilar depression, thick–walled (0.4–0.6 µm), honey yellow to ochraceous in water and 5% KOH, with one or, more rarely, two or three large oil droplets when mature, inamyloid or a very small minority dextrinoid, acyanophilic to less frequently cyanophilic and with a faint metachromatic reaction. *Basidia* 23–44(–46) × 9–14 µm (n = 23), cylindrical-clavate to clavate, vesciculose to subglobose in the inner hymenophoral tissues, moderately thick-walled (0.5–1.0 µm), predominantly 4-spored but also 1- or 2-spored, usually bearing short to moderately long sterigmata (2–7 µm), hyaline to pale yellowish and not containing straw-yellow oil guttules in water and 5% KOH, bright yellow to ochraceous (inamyloid) in Melzer's, without basal clamps; basidioles cylindrical-clavate, clavate to subglobose in the inner hymenophoral tissues, about the same size as basidia. *Cheilocystidia* (26–)27–65(–70) × (5–)6–17(–21) µm (n= 23), very common, short to moderately long, straight to flexuous, versiform, irregularly cylindrical, cylindrical-fusiform, ventricose-fusiform, mucronate to less frequently bottle–shaped or sublageniform, with neck ranges from narrow and short to very long, with rounded to subacute tip, smooth, moderately thick-walled (0.5–1.0 µm), hyaline to pale straw yellow in water and 5% KOH, bright yellow to ochraceous (inamyloid) in Melzer's, without

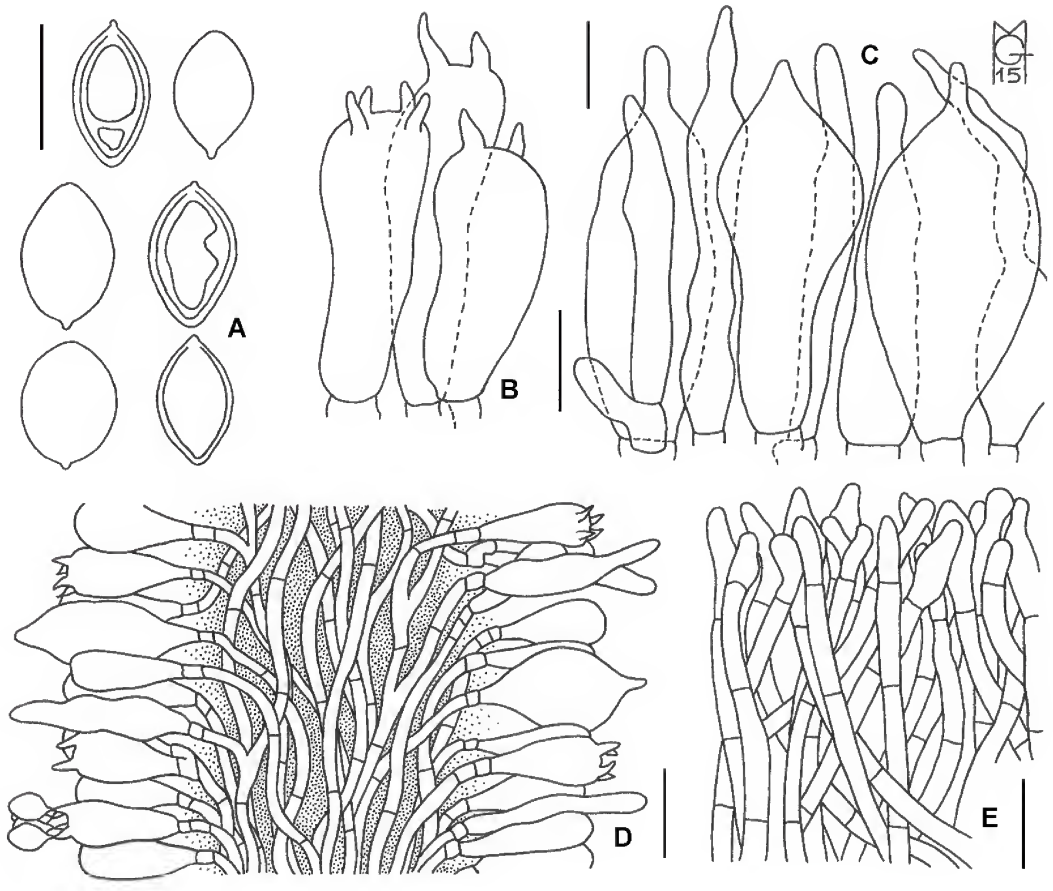

Fig. 6. ***Gymnogaster boletoides.*** A. basidiospores. B. basidia. C. cheilo- and pleurocystidia. D. hymenophoral trama (direction of hyphae from the bottom to the top, stippling in the drawing representing a gelatinous matter). E. pileipellis. All from *Halling et al. MG605* (BRI). Scale bars: A–C: 10 µm, D–E: 20 µm. Del. M. Gelardi.

epiparietal encrustations. *Pleurocystidia* (36–)38–65(–68) × (5–)6–20(–27) µm (n= 20), uncommon, shape, size, colour and chemical reactions as in cheilocystidia, usually showing a narrow and short neck. *Pseudocystidia* not recorded. *Pileipellis* (when pileus present), a trichoderm consisting of subparallel (towards the margin of the disc) to moderately interwoven (at the center of the disc), erect, elongated, filamentous and sinuous, rarely branched hyphae not embedded in gelatinous matter; terminal elements (10–)12–30(–36) × 4–9(–11) µm (n = 16), relatively short, irregularly cylindrical, bullet–shaped or acorn–shaped to less frequently cystidioid or clavate, rarely diverticulate, apex rounded–obtuse to sometimes pointed, moderately thick-walled (up to 0.9 µm), honey yellow to ochraceous in water and 5% KOH or with a slowly soluble red pigment in hydroxide mounting media, inamyloid in Melzer's, smooth; subterminal elements similar in shape, size and colour to terminal elements. *Hymenophoral trama* 30–50(–60) µm broad, consisting of very slightly divergent or almost parallel or subparallel, loosely arranged, gelatinized hyphae with nearly no differentiation between mediostratum and lateral strata [hyphae in transverse section remaining separate and (1–)2–6 µm apart, 2–10 µm broad, with a tendency to spread from the inner hymenophoral tissues towards the peripheral areas], straw yellow in water and hyaline to very pale yellowish in 5%

KOH, inamyloid in Melzer's. *Stipitipellis* a texture of slender, subparallel to loosely intermingled and longitudinally oriented, smooth walled, appressed hyphae, 2–10 µm wide, straw yellow to honey yellow in water and in 5% KOH; stipe apex covered by a well–developed caulohymenial layer consisting of sterile caulobasidioles, very sparse, 1-, 2- and 4-spored, fertile caulobasidia (these latter not detected at all in collection *MG607*) and abundant short to projecting *caulocystidia* similar in shape and colour to hymenial cystidia but distinctly smaller, irregularly cylindrical, cylindrical–fusiform, ventricose–fusiform to sublageniform or bullet–shaped, (14–)18–42(–46) × 4–12 µm (n = 20), having a wall up to 1 µm thick. *Columella* composed of densely arranged, subparallel to loosely interwoven, filamentous to slightly inflated, smooth, inamyloid hyphae, 3–19 µm broad. *Stipe trama* composed of densely arranged, strongly interwoven, smooth, inamyloid, filamentous hyphae intermixed with inflated or vesciculose to nearly subglobose cells, 3–20(–26) µm broad. *Oleiferous hyphae* present. *Clamp connections* absent in all tissues. **Figs. 1–6.**

***Additional specimens examined*: Australia: Queensland.** Darling Downs District: Road from Dalby to Bunya Mountains NP, Feb 2013, *Halling 9800 & Fechner* (BRI, NY); Cunningham's Gap, Main Range NP, Mar 2011, *Halling 9455 & Fechner* (BRI, NY). Moreton District: Rainforest Circuit, Maiala NP, Mt Glorious, Apr 2014, *Gelardi MG607 et al.* (BRI); Thylogale Track, along Mt Nebo Road between Boombana and Jolly's Lookout, Mt Nebo, Apr 2014, *Halling et al. MG605* (BRI); Main Range NP, road from Boonah to Killarney, Mar 2012, *Halling 9664* (BRI, NY).

***Distribution and habitat*:** *Gymnogaster boletoides* is currently known primarily from eastern Australia (Queensland, New South Wales, Victoria), with a single collection recorded from Western Australia (**Map 1**). Fruiting bodies are gregarious or scattered amongst litter in wet sclerophyll forests dominated by Myrtaceae (*Eucalyptus* L'Hér., *Lophostemon* Schott. and *Corymbia* K.D.Hill & L.A.S.Johnson). Details of non-vouchered observations can be found on Mushroomobserver.org (Observations #66652, #163760), and on the Atlas of Living Australia (ALA); http://www.ala.org.au/.

***Typification*:** The holotype of *Gymnogaster boletoides* consists of two incomplete halves of a fruiting body < 10 mm diameter. This material has been stored in various liquid media for the past 60 years and is now a discoloured, fragile, deficiently prototypical collection which would be best served by augmentation with a fresher, well annotated and photographed dried collection as, at a minimum, a representative specimen which is more interpretive of the protologue description of both the genus and species. We therefore propose the collection *Halling 9455 & Fechner* (BRI) as a representative collection for the species. Cunningham's Gap is less than 90 km from the original holotype location, Mt. Glorious. The representative specimen has the added benefit of having been sequenced for DNA analyses, with six associated sequences lodged in GenBank: nrLSU: JX889673; tef1: JX889683; 28S: KT990572; tef1: KT990768; RPB1: KT990928; RPB2: KT990406.

***Affinities*:** *Gymnogaster boletoides* undoubtedly approaches *Neoboletus thibetanus* (Shu R. Wang & Yu Li) Zhu L. Yang, B. Feng & G. Wu from the morphological viewpoint. However, as already pointed out by Wu *et al.* (2016a), and based on the protologue by Wang *et al.* (2014) and our own observations, the latter species can be readily delimited by the apical peridial remnants being essentially absent (if a peridiopellis is present, then it shows a hymeniderm structure with inflated terminal elements, 8–15 µm broad, or a cutis with repent filamentous hyphae); presence of a short, shallow reticulum at the stipe apex; much larger basidiospores, 16–19(–20) × (9–)9.5–11(–11.5) µm; shorter and differently shaped cystidia; narrower columella hyphae and stipe trama hyphae (3–7 µm broad), and its occurrence in south-western China in subalpine conifer forests dominated by *Abies* Mill. and *Betula* L. Furthermore, recent molecular phylogenetic analyses indicate that *N. thibetanus* clusters in a distantly related clade focused on the complex of the boletoid, pileate–stipitate species *N. luridiformis* (Rostk.) Gelardi, Simonini & Vizzini (Wu *et al.* 2016a).

Gymnopaxillus nudus Claridge, Trappe & Castellano resembles *G. boletoides* but diverges from the latter species in having a (sub-) hypogeous habit; absence of stipe, or only rarely with a very rudimentary stipe; unchanging tissues; presence of white basal rhizomorphs; pileus surface (whenever present) consisting of interwoven, collapsed hyphae; hymenium devoid of cystidia, and differently shaped, cyanophilic, boletoid basidiospores which are longer and narrower, being (10–)11–16(–17.5) × (4.5–)5.5–6.5(–7.5) µm (Claridge *et al.* 2001). Moreover, the genus *Gymnopaxillus* E. Horak is phylogenetically allied to *Austropaxillus* Bresinsky & Jarosch in the family Serpulaceae Jarosch & Bresinsky (Claridge *et al.* 2001; Jarosch 2001; Binder & Hibbett 2006; Watling 2008; Skrede *et al.* 2011).

***Notes*:** *Gymnogaster boletoides* is easily circumscribed on account of the following set of unique and distinctive macro- and micromorphological characters: (1) small to tiny basidiomes (1–3.5 cm high × 0.7–5 cm broad); (2) completely exposed morchellioid, whitish to lemon yellow and eventually olive–brown hymenophore with irregularly shaped chambers; (3) pileus surface reduced to a small brownish–red disc at top; (4) reduced stipe continuing as a columella inside the hymenophore; (5) tissues definitely cyanescent overall on exposure or handling; (6) symmetrical, amygdaliform to citriform, smooth basidiospores; (7) pileipellis a trichoderm consisting of subparallel to moderately interwoven cylindrical hyphae; (8) hymenophoral trama consisting of subparallel and loosely arranged, strongly gelatinized hyphae; (9) fertile caulohymenium; (10) occurrence in wet sclerophyll forests in association with Myrtaceae.

The single, disjunct occurrence of this taxon in Western Australia, as illustrated on the ALA website (**Map 1**), could not be ignored. Whilst the authors did not get the opportunity to examine this specimen, the description accompanying the specimen record was sufficiently detailed enough to convince the authors that the identification was correct. In terms of the list of prescriptive characters outlined in the preceding paragraph, the following descriptors matched very closely, including spore dimensions: "Pileus crimson red, smooth ….. hymenium greenish yellow, with faint and inconsistent dull greenish-blue bruising and some dull reddish bruising when cut; forming a broad mass of convoluted plates with empty locules in between. Stipe columella: solid, extending to apex of fruit body; upper part dull greenish-blue entirely when cut, lower part dull yellowish with red bruising when cut ….. spores dull yellowish-brown in KOH and in Melzers, ellipsoid, some with slightly attenuated apex, thick and smooth-walled, 10.5–13.0(–13.3) × (6.3–)6.9–8.4 µm …."

From a morphological perspective *Gymnogaster boletoides* may be considered an intermediate transition of an above-ground bolete to a truffle-like form in which a vestigial pileus and a reduced stipe combined with an epigeal growth are still retained. The similarities to boletes are quite evident when considering the bluing reaction and the mycorrhizal habit. According to present knowledge, *G. boletoides* seems to have an ecologically restricted distribution range and appears to be endemic to Australia.

***Etymology*:** the specific epithet is derived from the Latin *boletus* (mushroom) and the suffix *–ides* (resembling), referring to the similarity of its characters to species in the genus *Boletus s.l.*

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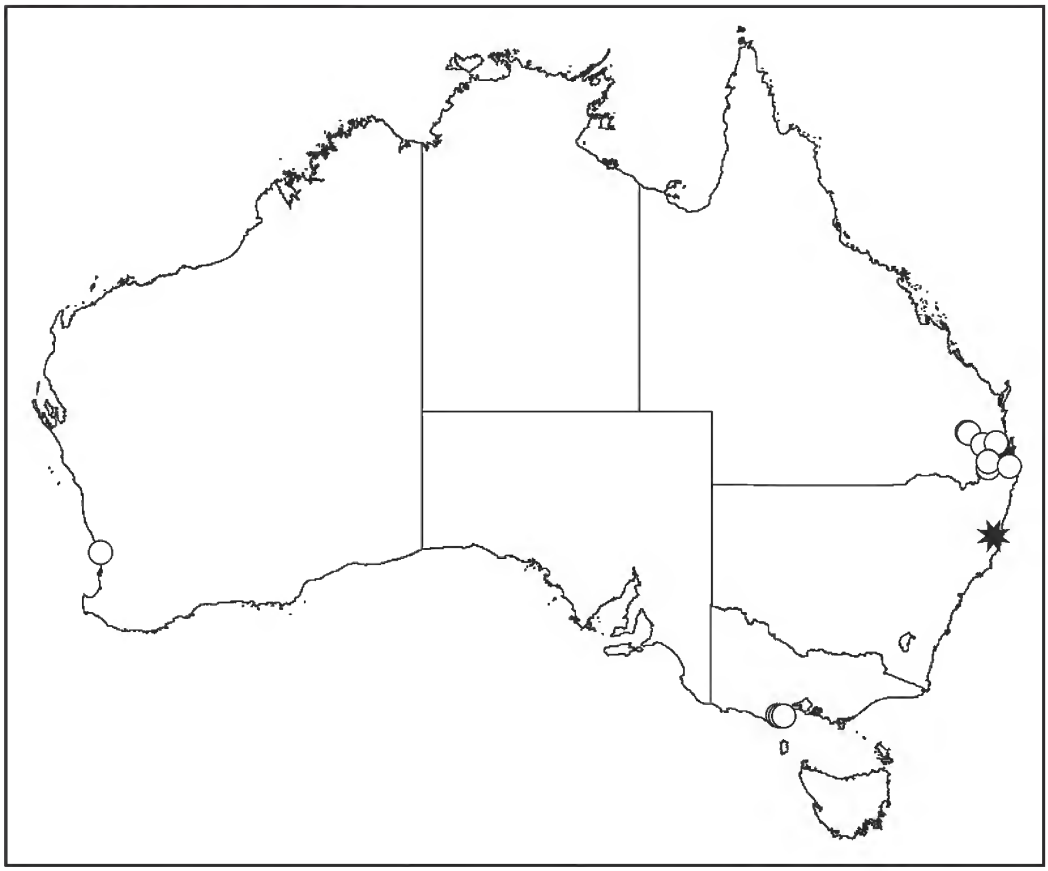

Map 1. Distribution of ***Gymnogaster boletoides*** ○. ✷ represents the collection (PERTH 07628005) from Dorrigo National Park, NSW which lacks a georeference and is therefore absent from the ALA map for this taxon. Source: Atlas of Living Australia occurrence; download at http://www.ala.org.au. Accessed 2 December, 2016.

Thismia hawkesii W.E.Cooper and *T. lanternatus* W.E.Cooper (Thismiaceae), two new fairy lantern species from the Wet Tropics Bioregion, Queensland, Australia

W.E. Cooper

Summary

Cooper, W.E. (2017). *Thismia hawkesii* W.E.Cooper and *T. lanternatus* W.E.Cooper (Thismiaceae), two new fairy lantern species from the Wet Tropics Bioregion, Queensland, Australia. ***Austrobaileya* 10(1): 130–138.** *Thismia hawkesii* and *T. lanternatus* are described and illustrated. Notes on habitat, habit and distribution are provided as well as a key to all species in Australia.

Key Words: Thismiaceae, *Thismia*, *Thismia hawkesii*, *Thismia lanternatus*, Australia flora, Queensland flora, Wet Tropics bioregion, new species, rainforest, identification key

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Introduction

Thismia Griffith (Thismiaceae) comprises *c.* 66 species occurring in Asia, America, New Zealand and Australia (Mabberley 2008; Mycoheterotrophic plants 2017) with the largest species diversity from South East Asia (Chantanaorrapint 2012). Most species are tropical, but a small number of species occur in subtropical and temperate areas in Australia, New Zealand and North America.

Thismia plants are terrestrial, achlorophyllous, mycoheterotrophic herbs that flower fugaciously amongst or beneath leaf litter and are very difficult to find, unless searchers are especially focused on finding plants of this genus during wet weather when they are only conspicuous by their flowers. *Thismia* plants lack chlorophyll and obtain carbohydrates and possibly other nutrients from adjacent photosynthetic plants by accessing fungal mycorrhizal networks (Leake 2005; Merckx & Wapstra 2013).

Five *Thismia* species have been described from Australia: *T. rodwayi* F.Muell. from Tasmania, Victoria, New South Wales (NSW), southeastern Queensland and New Zealand; *T. clavarioides* K.R.Thiele and *T. megalongensis* C.Hunt, G.Steenbeeke & V.Merckx from NSW; *T. yorkensis* Cribb from Cape York Peninsula in far north Queensland and *T. tectipora* Cowie from Melville Island, Northern Territory.

In 1963, a fruiting specimen (*Hyland 2879*, BRI) of an undescribed species of *Thismia*, later phrase-named as *T.* sp. Scrubby Creek (M.S.Hopkins & A.W.Graham 94/8) in CNS, was collected from the Herberton Range (now Baldy Mountain Forest Reserve). Fifty-four years later in 2017, Bernie Hyland, now retired, took the collectors of the type specimen back to the exact site for recollection! This species is described herein as *Thismia hawkesii* W.E.Cooper.

A second undescribed species was collected as a flowering specimen by Rigel Jensen (*Jensen 940*, BRI) in 1998, during a survey sifting rainforest leaf litter for Lumholtz's tree-kangaroo scats on the property *Ty-Gwyn* at Chilverton near Ravenshoe. Flowers and fruits were collected from the same location in 2003 (*Cooper 1817*, CNS) for illustration in Cooper and Cooper (2004; as '*T.* sp. Ty-Gwyn'). A further search of the same property in 2017 resulted in the type collection (*Cooper 2407 et al.*, CNS) for the species, described herein as *Thismia lanternatus* W.E.Cooper.

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These two new species bring the number of Australian species to seven.

Materials and methods

This study is based on examination of six voucher collections preserved in 70% ethanol from BRI, CNS and CANB, as well as freshly collected specimens. During the course of this study, hairs evident on fresh flowers of *T. hawkesii* were observed to diminish soon after immersion in 70% ethanol. Indeed, most specimens observed quickly become somewhat soft and fleshy in ethanol. For these reasons, *Thismia* descriptions should be made from fresh material as soon as possible after collection.

Abbreviations used in the specimen citations include SFR (State Forest Reserve) and NP (National Park).

Taxonomy

Key to Australian species of *Thismia*

1 Mitre-processes absent **2**
1. Mitre-processes present **3**

2 Roots coralloid; mitre white; outer tepals distinct and slightly reflexed . . . . **T. yorkensis**
2. Roots vermiform; mitre black or dark brown; outer tepals absent or minute (not visible to the naked eye), not reflexed . . . . . **T. lanternatus**

3 Mitre-process a solitary, terminal tentacle-like process **4**
3. Mitre-processes comprised of 3 lateral or terminal tentacle-like processes **5**

4 Perianth tube with 6 toothed ribs . . . . . **T. hawkesii**
4. Perianth tube without toothed ribs . . . . . **T. tectipora**

5 Perianth tube whitish or colourless; mitre-processes > 20 mm long . . . . . **T. clavarioides**
5. Perianth tube yellow, orange or reddish; mitre-processes < 5 mm long **6**

6 Outer perianth lobes terminating in a bristle 2–8 mm long . . . . . **T. megalongensis**
6. Outer perianth lobes not bristle-tipped . . . . . **T. clavarioides**

1. Thismia hawkesii W.E.Cooper **sp. nov.** Similar to *T. betung-kerihunensis* Tsukaya & H.Okada, but differing in the perianth tube bluish in basal area (rather than at the apices), urceolate (versus cone-shaped), having 6 dentate ribs (versus ribs lacking), and the mitre being blackish (versus blue-green) and dished (versus domed) at the apex. **Typus:** Queensland. Cook District: Baldy Mountain Forest Reserve, Herberton Range, near Atherton, 29 January 2017, *W. Cooper 2407, R. Jensen, B. Hyland, T. Hawkes, T. de Groot & B. Gray* (holo: CNS [spirit only]).

Thismia sp. Scrubby Creek (M.S.Hopkins & A.W.Graham 94/8)

Achlorophyllous, fleshy herb, lacking above-ground stems and with flowers borne at ground level, fleshy; roots coralloid, densely clustered. **Leaves** spirally arranged, scale-like, narrowly triangular, 2–3.5 mm long, *c.* 1 mm wide at base, whitish, glabrous, papillose; base truncate; apex acute, entire. **Bracts** subtending flowers ovate, mostly keeled, 3.5–6.5 mm long, to 3.5 mm wide, cream-coloured. **Flowers** solitary, sessile, terminal, actinomorphic, 18–26 mm long (including mitre-process); mitre-process a solitary, terminal tentacle-like process; **perianth** 14–22 mm long (including mitre process), 7–8 mm wide; **tube** inflated, urceolate, 6-ribbed with ribs dentate, glabrous except for short hairs lining the aperture margin, white in upper half, aqua-blue ageing to olive-green in lower half, the ribs blackish or very dark brown; **outer tepals** absent or comprising narrow wings to *c.* 0.15 mm long, blackish or very dark brown, glabrous; **inner tepals** 3, 8.5–9.5 mm long (including mitre-processes), *c.* 5.5 mm wide at the widest part, somewhat

trullate, connate (rarely separating with age), forming a hood over each opening and with 3 vertical lobes creating a dished or doughnut-shaped depression at apex; mitre-processes terminal, 3-sutured, slender, 5–8.5 mm long, blackish or very dark brown, glabrous; **stamens** 6, connate and forming a pendulous tube hanging from perianth aperture, each with 2 adaxially positioned shallow loculi, indigo-blue, abaxial and adaxial surfaces with erect, colourless, translucent trichomes; **connectives** rectangular with acute apical lobes; **lateral appendages** flattened, adaxial, large, wing-like, ± square or sometimes almost hastate, with an acute apex and erect, colourless, translucent, marginal trichomes; **anthers** adaxial, extrorse, pale yellow; **style** *c.* 1 mm long with 3, erect, oblong, emarginate stigmatic lobes, each with minute erect trichomes abaxially and adaxially; **ovary** inferior, not delimited from hypanthium, unilocular, 3-carpellate, oblate, smooth, aqua-blue, glabrous; ovules numerous. **Fruit** a cup-shaped capsule *c.* 4.5 mm long and 7.5 mm wide, on a pedicel elongated to *c.* 75 mm above bracts; seeds numerous, spindle-shaped, *c.* 0.5 mm long. **Figs. 1 & 2.**

***Additional specimens examined*: Queensland.** Cook District: SFR 194, Scrubby Creek Water Intake, Carrington Road, Feb 1994, *Hopkins & Graham 94/8* (CNS); [SF]R194 CPT 50, Jun 1963, *Hyland 2879* (BRI).

***Distribution and habitat*:** *Thismia hawkesii* occurs in simple notophyll vine forest dominated by *Cardwellia sublimis* F.Muell., *Darlingia darlingiana* (F.Muell.) L.A.S.Johnson, *Doryphora aromatica* (F.M.Bailey) L.S.Sm., *Flindersia brayleyana* F.Muell., *Neisosperma poweri* (F.M.Bailey) Fosberg & Sachet, *Neolitsea dealbata* (R.Br.) Merr. and *Toechima erythrocarpum* (F.Muell.) Radlk.

***Phenology*:** Flowers have been recorded in January and February; fruit has been recorded in June.

***Notes*:** *Thismia hawkesii* is morphologically similar to *T. betung-kerihunensis* Tsukaya & H.Okada from Borneo (Tsukaya & Okada 2005) rather than to other Australian species. It most noticeably differs from that species in the perianth tube being bluish in the basal area (rather than at the apices), urceolate (versus cone-shaped), with 6 dentate ribs (versus ribs lacking), and the mitre being blackish (versus blue-green) and dished (versus domed) at the apex.

***Etymology*:** The specific epithet *hawkesii* is in honour of naturalist and enthusiastic field assistant, Tim Hawkes (1965–).

2. Thismia lanternatus W.E.Cooper **sp. nov.** Similar to *T. mucronata* Nuraliev but differing in the mitre black or very dark brown (versus greyish-white), mitre apex shortly nipple-like (versus an erect pyramidal mucro), outer tepals very short, wing-like and blackish (versus broadly triangular and greyish-white) and ovary conical (versus obconic). **Typus:** Queensland. Cook District: Ty-Gwyn, Chilverton near Ravenshoe, 29 January 2017, *W. Cooper 2403, R. Jensen, T. Hawkes & T. de Groot* (holo: CNS [spirit only]).

***Illustration*:** Cooper & Cooper 2004: 95 (as '*Thismia* sp. Ty-Gwyn')

Achlorophyllous, fleshy herb, lacking above ground stems and with flowers borne at ground level; roots vermiform, terete, branched, 1.6–2 mm thick. **Leaves** spirally arranged, scale-like, triangular, *c.* 5 mm long, 2.5–3 mm wide at base, whitish, glabrous, papillose; base truncate; apex acute, entire. **Bracts** subtending flowers triangular, keeled, 4–10 mm long, 2.5–5 mm wide, papillose, cream-coloured. **Flowers** solitary, sessile, terminal, actinomorphic, without mitral lobes; **perianth** 25–26 mm long; **tube** inflated, obovoid, dirty yellow with 12 longitudinal orange or dark-purplish veins, glabrous; aperture margin with 6 crenate lobes; **outer tepals** 3, very short and wing-like, *c.* 0.5 mm long and 7 mm wide, black or very dark brown; **inner tepals** 3, trullate, *c.* 11 mm long, to 11–12 mm wide at widest point, connate and together forming a flattish dome or mitre *c.* 6 mm above the perianth aperture with a nipple-like apex, black or very dark brown, glabrous; **stamens** 6, connate and forming a pendulous tube hanging from perianth aperture, each with 2 adaxially positioned shallow loculi, the abaxial surface facing the centre of the perianth tube whitish;

Fig. 1. ***Thismia hawkesii*** flowers with an immature fruit on the right hand side (*Cooper 2407 et al.*, CNS). Photo: R. Jensen

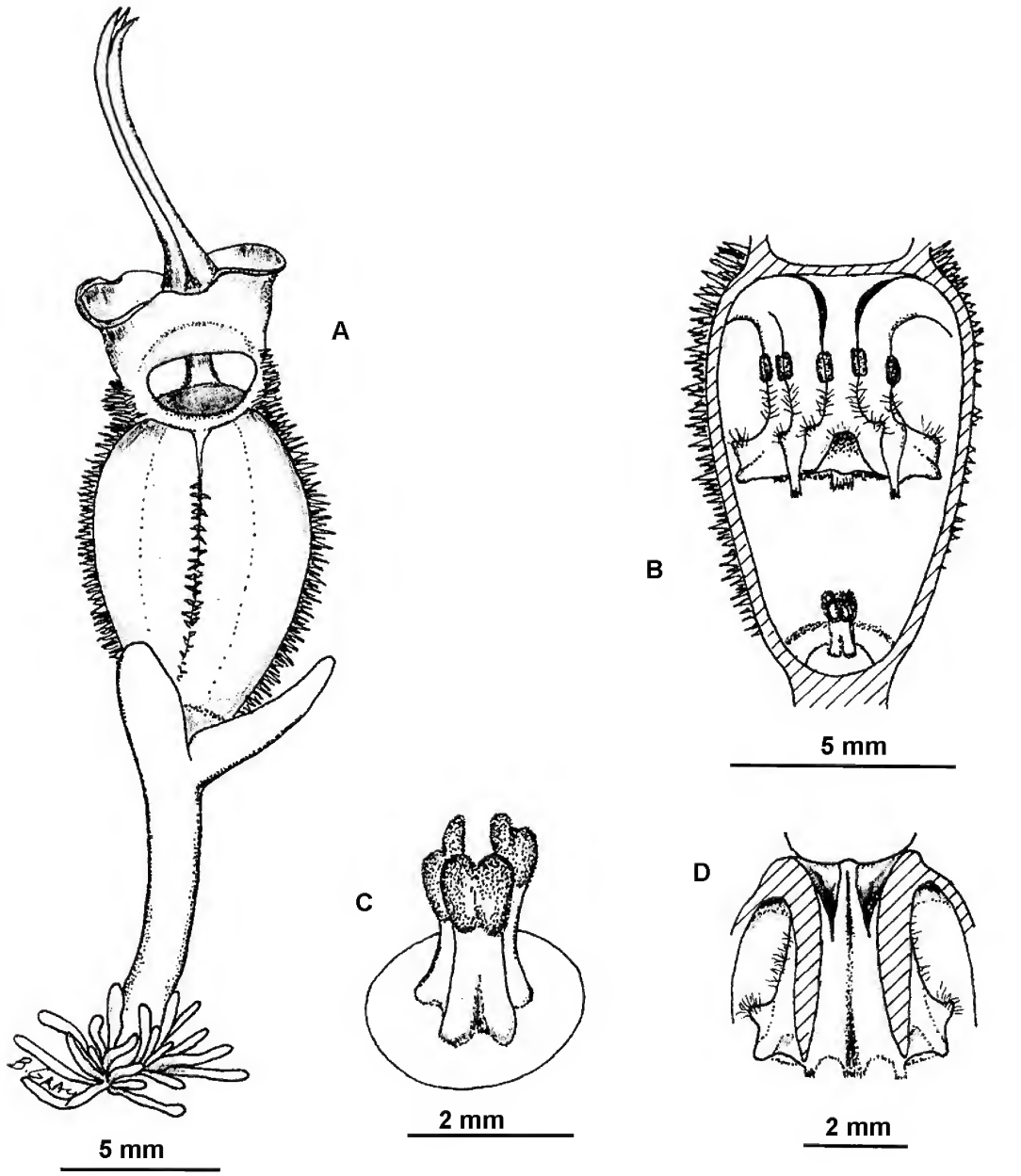

Fig. 2. ***Thismia hawkesii***. A. habit showing stem, leaves, flower and roots. B. flower, longitudinal cross-section showing pendulous stamens, anthers, style and stigmas. C. stigmas and operculum. D. pendulous stigmas showing abaxial surface in the centre of the flower. Scales as indicated. All from *Cooper 2407 et al.* (CNS). Del. B. Gray.

connectives rectangular with 3- or 4-toothed apices; **lateral appendages** flattened and wing-like, adaxial, ± square; **anthers** adaxial, extrorse, pale yellow; **style** *c.* 2.5 mm long with 3 deeply divided, narrowly-triangular, erect, lanceolate stigmatic lobes *c.* 1.8 mm long, each acute at apex and with minute, erect trichomes abaxially and adaxially; **ovary** inferior, not delimited from hypanthium, unilocular, 3-carpellate, conical, *c.* 5 mm long and 3 mm wide, glabrous; ovules numerous. **Fruit** (only one unripe fruit seen) cup-shaped, *c.* 5 mm long and wide, cream-green with brownish dots. **Figs. 3 & 4.**

Fig. 3. ***Thismia lanternatus*** flowers (*Cooper 2403 et al.*, CNS). Photo: T. Hawkes

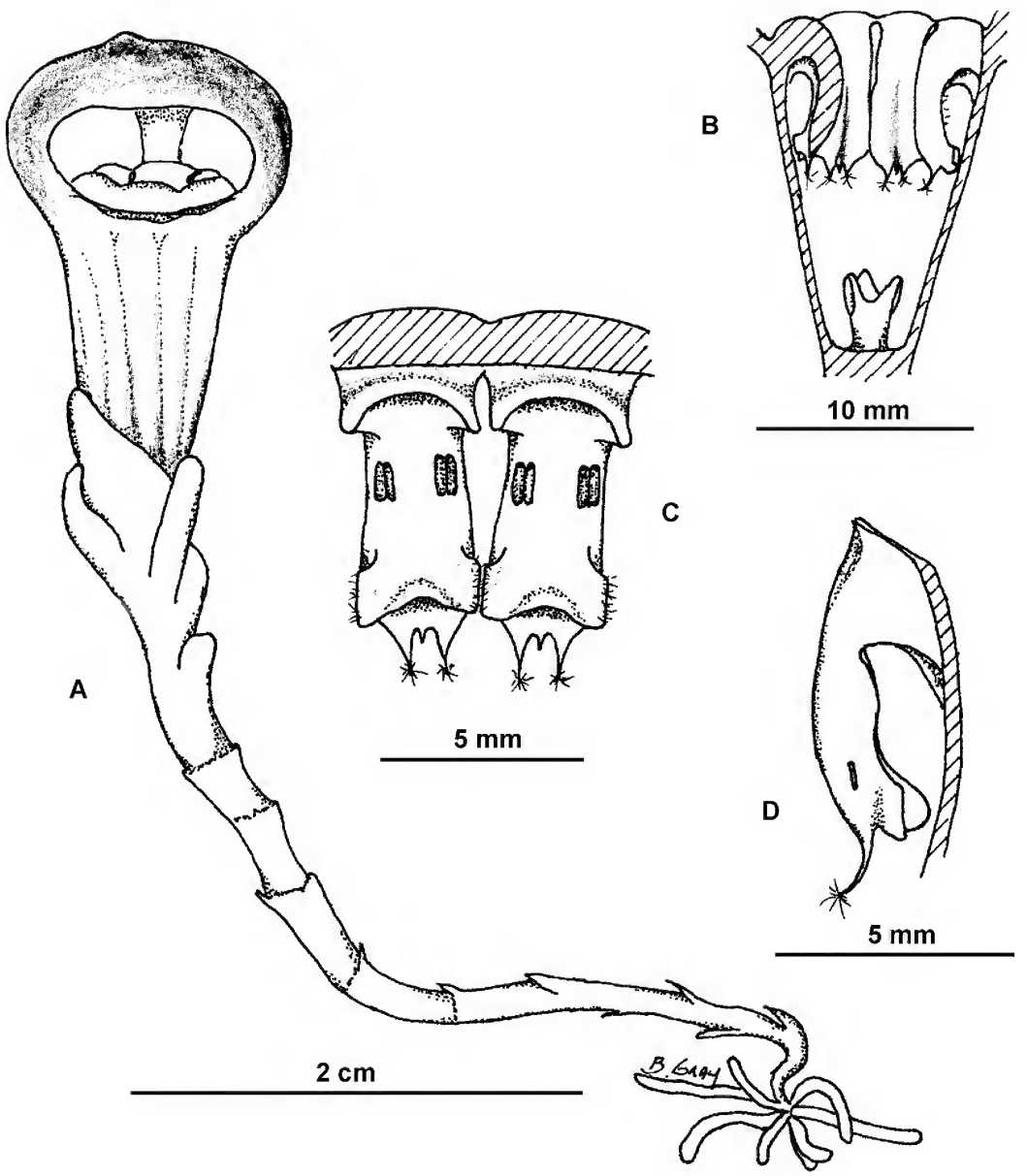

Fig. 4. ***Thismia lanternatus.*** A. habit showing stem, bracts, leaves, flower and roots. B. flower, longitudinal cross-section showing pendulous stamens, style and stigmas. C. pendulous stigmas showing adaxial surface and anthers. D. stamen lateral view showing lateral appendages. Scales as indicated. All from *Cooper 2403 et al.* (CNS). Del. B. Gray.

***Additional specimens examined*: Queensland.** Cook District: Chilverton on Kennedy Highway near Ravenshoe, Dec 1998, *Jensen RJ940* (BRI); Chilverton near Ravenshoe, March 2003, *Cooper WWC1817 & Cooper* (BRI).

***Distribution and habitat*:** *Thismia lanternatus* is known only from a small area of disturbed rainforest on metamorphic soil at Chilverton near Ravenshoe on the Atherton Tablelands. The surrounding forest is dominated by *Beilschmiedia tooram* (F.M.Bailey) B.Hyland, *Caesalpinia robusta* (C.T.White) Pedley, *Cardwellia sublimis* F.Muell., *Castanospora alphandii* (F.Muell.) F.Muell., *Daphnandra repandula* (F.Muell.) F.Muell., *Doryphora aromatica* (F.M.Bailey) L.S.Sm. & *Neolitsea dealbata* (R.Br.) Merr.

***Phenology*:** Flowers have been recorded in December, January & February. Unripe fruit has been recorded in March.

***Notes*:** *Thismia lanternatus* is morphologically most similar to *T. mucronata* Nuraliev from Vietnam (Nuraliev *et al.* 2014) rather than other Australia species. It differs from that species in the mitre of the flower being black or very dark brown (versus greyish-white), with the apex shortly nipple-like (versus an erect pyramidal mucro), the outer tepals very short, wing-like and blackish (versus broadly triangular and greyish-white) and the conical ovary (versus obconic).

Ho *et al.* (2009) noted that *Thismia tentaculata* K.Larsen & Aver. occurred in close proximity to both *Burmannia itoana* Makino (Burmanniaceae) and *Sciaphila ramosa* Fukuy. & T.Suzuki (Triuridaceae). An undetermined *Thismia* (*Brass 23549*, CANB) collected from Milne Bay in Papua New Guinea was associated with *Corsia* (*Brass 23548*, CANB) and *Sciaphila* (*Brass 23550*, CANB). We collected flowering *Corsia dispar* D.L.Jones & B.Gray (*Cooper 2404*, *Jensen, Hawkes & de Groot*, CNS), less than one metre from *Thismia lanternatus (Cooper 2403 et al.*, CNS*)*. From these records, it seems likely that *Thismia* plants may often occur with other mycoheterotrophic plants.

***Etymology*:** The specific epithet is derived from the Latin *lanterna* (lantern) and *-atus* (resembling), referring to the lantern-like flower.

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Elionurus purpureus E.J.Thomps. (*Panicoideae*: *Andropogoneae*: *Tripsacinae*), a new species for Queensland: circumscription and breeding system

E.J. Thompson

Summary

Thompson, E.J. (2017). *Elionurus purpureus* E.J.Thomps. (*Panicoideae*: *Andropogoneae*: *Tripsacinae*), a new species for Queensland: circumscription and breeding system. ***Austrobaileya* 10(1): 139–162**. A new species of *Elionurus* Willd. endemic to northeast Queensland is described and illustrated. It is distinguishable from *E. citreus* by the annual growth habit and spikelet morphology. The leaf anatomy of the two Australian species of *Elionurus* is illustrated and compared. The spikelet morphology of the two Australian species is contextualised within *Elionurus*, *Tripsacinae* and *Rottboellinae*. A new distinguishing morphological character for *Elionurus* is presented, *viz.* the proximal beak on the sessile spikelets, which is shared by the African genus *Urelytrum* Hackel (*Tripsacinae*), and some Australian genera in other subtribes of *Andropogoneae*. The breeding system that involves cleistogamy is discussed for the two Australian species of *Elionurus*.

Key Words: Poaceae, *Andropogoneae, Rottboelliinae*, *Tripsacinae*, *Elionurus*, *Elionurus citreus*, *Elionurus purpureus*, Queensland flora, taxonomy, new species, cleistogamy, morphological characters, leaf anatomy, stem anatomy, cultivated plants

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Introduction

Elionurus Willd. is a genus of 15 species of tropical and subtropical caespitose grasses, 13 perennial and two annual. Nine (six endemic) species occur in Africa, five (two endemic) from southern North America, four (three endemic) from South America, one from India, and one species recorded for Australia and New Guinea (Clayton 1973; Clayton & Renvoize 1986; Watson & Dallwitz 1992). *Elionurus* has been placed in the tribe *Andropogoneae* subtribe *Rottboelliinae* on the basis of morphology (Watson & Dallwitz 1992) and a molecular phylogeny by Soreng *et al.* (2015), although Kellogg (2015) placed it in *Andropogoneae*, *incertae sedis* based on earlier molecular phylogenies. Soreng *et al.* (2017) in an updated phylogeny placed *Elionurus* in subtribe *Triplacinae*. Members of the tribe typically have racemose inflorescences composed of disarticulating segments made up of a pair of differentiated spikelets (sessile and pedicellate) and a rachilla (Stapf 1934; Renvoize 1978; Watson & Dallwitz 1992). These spikelet pairs have phylogenetic significance and are considered by Zanotti *et al.* (2010) to be the evolutionary origin of the solitary spikelets in the sister tribe, *Paniceae*.

Tripsacinae is currently represented worldwide by a further six genera, none of which are native to Australia and includes the significant food plant maize (*Zea* L.) (Soreng *et al.* 2017). In the updated phylogeny of these grasses, Soreng *et al.* (2017) transferred five genera from *Rottboelliinae* to *Tripsacinae* that had previously comprised only *Tripsacum* L. and *Zea*, thus leaving *Rottboelliinae* with 16 genera. Species of *Tripsacinae* and *Rottboelliinae* have unbranched inflorescences and lack the conspicuous geniculate spiralled awn on the sessile spikelets present in most other subtribes of *Andropogoneae* (Clayton 1973; Clayton & Renvoize 1986; Watson & Dallwitz 1992; Kellogg 2015), although awnless spikelets also occur in subtribes *Chionachninae* and *Coicinae* (Soreng *et al.* 2017). Clayton (1973) used morphological

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characters in a numerical analysis of species of *Andropogoneae* with awnless sessile spikelets covering 22 of the 23 genera from *Tripsacinae* (except *Zea*) and *Rottboelliinae* and presented similarity diagrams for the genera. Clayton (1973) considered *Rottboelliinae* to be a recent evolutionary branch disjunct from other members of the tribe.

The previous single Australian species, *Elionurus citreus* (R.Br.) Munro ex Benth., lemon-scented grass, occurs along the northern tropical and eastern subtropical coast of Australia and New Guinea (Simon & Alfonso 2011). This species is described and illustrated by Tothill & Hacker (1983) and Jacobs *et al.* (2008).

Lemon-scented foliage also occurs in other species of *Andropogoneae*, where fragrance of leaves has been used sometimes as a taxonomic character in keys to genera by Stapf (1934) and Simon (2002). Lemon-scented foliage is found in the Australian grass *Cymbopogon ambiguus* A.Camus (Australian lemon-scented grass), several species and cultivars of *Cymbopogon* Spreng. (lemon grass, citronella grass) from Asia, and *Elionurus muticus* (Spreng.) Kunth (lemon grass) from South America and Africa. The Asian and South African grasses are commercial sources of lemon-scented essential oils (e.g., citral, citronellol, geraniol) (Soenarko 1977; Watson & Dallwitz 1992; Sangwan *et al.* 2001; Nakaharar *et al.* 2003; Fuller *et al.* 2014; Kellogg 2015). Other essential oils (predominantly campherenone) have been reported in leaves and roots of *Elionurus elegans* Kunth, an annual from Africa (Mevy *et al.* 2002).

The breeding systems in grasses are highly diverse (Connor 1979) and in *Panicoideae* this is particularly so for the genera comprising *Tripsacinae* as represented by Soreng *et al.* (2017). *Tripsacum* L. and *Zea* provide unusual diversity in breeding systems for subtribes in *Andropogoneae*. *Tripsacum* has male and female flowers in separate portions of the same inflorescences, as is found in *Chionachne* R.Br. (subtribe *Chionachninae*) and *Zea* has male and female inflorescences in different parts of the same plant (Watson & Dallwitz 1992). All of the species of *Tripsacinae* and *Rottboelliinae* have bisexual flowers and most are solely chasmogamous (CH), where anthers and stigmas emerge from florets with the ability to outcross and thereby provide gene flow (Watson & Dallwitz 1992; Simon & Alfonso 2011). The one known exception until now is the presence of cleistogamy (CL) (self-pollination within a closed flower), in *Rottboellia exaltata* L.f. reported by Heslop-Harrison (1959). Various types of CL have been reported for species in other subtribes of *Andropogoneae* (Connor 1979; Campbell *et al.* 1983; Watson & Dallwitz 1992; Culley & Klooster 2007).

This paper provides a taxonomic account of a new species of *Elionurus* with lemon-scented foliage from north Queensland. The breeding systems of the two Australian species of *Elionurus* are presented and categorised according to current CL classifications from the literature (**Table 1**). Morphological affinities of *Elionurus* to other genera of *Rottboelliinae* are also discussed.

Materials and methods

Field survey at the site of the type collection of *Elionurus purpureus* was conducted in three successive years, April 2015, April 2016 and May 2017.

A comparative study of gross morphology and anatomy was made for *E. purpureus* and *E. citreus*. Morphological data for *E. purpureus* were obtained from four accessions at BRI which includes the type (**Fig. 1**). Spikelets from terminal and axillary inflorescences were dissected to examine their characters. Six topotypes from Queensland Herbarium (BRI) collections of *E. citreus* were selected for sampling (**Appendix 1**). These specimens were collected in the vicinity of the type and are considered representative substitutes for the type, a collection by Robert Brown (*Bennett no. 6176*) made in 1802 from Northumberland Island, Queensland. Online images of the isotype (*Andropogon citreus* R.Br.) at E, K and W were examined.

Table 1. Morphological character differences between the Australian species of *Elionurus*

Character	*Elionurus purpureus*	*Elionurus citreus*
Growth habit	annual	perennial
Inflorescence type	multiple racemes at nodes at least on cultivated plants	single racemes at nodes on cultivated plant and topotypes
Culms		
Transverse section shape	broadly concavo-convex	narrowly concavo-convex
Anatomy		
sclerenchyma along convex edge	mostly 3 or 4 cells wide	mostly 6–8 cells wide
Leaf blade and sheath		
Distribution	cauline	mostly basal
Margin prickle hairs	absent	medium (60–70 μ)
Abaxial surface		
length of stomata (μm)	45–60	41–51
length of silica bodies (μm)	15–20	8–15
Margins and mid-vein indumentum	smooth	usually scabrid
Mid-vein	obtusely keeled	acutely keeled
Anatomy of vascular bundles		
adaxial sclerenchyma	absent	present
Sessile spikelet (mid raceme*)		
Total length (beak, body and lobes) (mm), colour at maturity	8.1–9.2, purple	10.6–13.1, pallid to pale pink, rarely purplish
Lower glume		
lobe length (mm)	2.6–3.2	5.5–7
body width × length (mm), texture	1.7–2 × 3.5–4.2, chartaceous	1.5–1.7 × 3.6–4.3, cartilaginous
indumentum type, orientation	pubescent, appressed	glabrous to pilose, ascending
hair length (mm)	*c.* 0.2	*c.* 2
keeled margin of lower glume	not winged	narrowly winged
Upper lemma		
margin	hyaline, pilose, hairs *c.* 0.3 mm long	hyaline, ciliate apically or glabrous
apex	acute	attenuate
Callus		
length (mm)	1–2.3	1.8–2.7
*apical spikelets are smaller and basal larger		
Pedicellate spikelet		
Lower glume		
width × length (mm), colour at maturity, body, margins	0.8–1.3 × 5.2–5.7, purple; lanceolate, asymmetrical, 5-veined, 1-keeled, both margins with *oil streak*	*c.* 0.9 × 7.2–8.5, pallid to pale pink, rarely purplish, linear to narrow lanceolate, asymmetrically, 3-veined, 1-keeled, one margin with *oil streak*
Upper glume	subequal to lower glume, 5-veined, back rounded	unequal to lower glume, 3-veined, back laterally compressed
Anther length (mm)		
Chasmogamous	0.9–2	1.3–2.7
Cleistogamous	*c.* 0.8	0.7–1.8
Rachilla		
Width × length (mm), shape	1.2–1.4 × 4.3–4.4, distinctly clavate distinctly winged, unequally bilobed	0.9–1.3 × 3.3–5, clavate usually narrowly winged and unequally bilobed, or not winged
Apex rim		
Sub-apical beard		
length of longest hairs (mm)	2.8–2.9	3.6–4.9
Pedicel		
Width × length (mm), shape	*c.* 0.8 × 2.5–3.5	0.5–0.6 × 2.9–4

Fig. 1. Holotype specimen of *Elionurus purpureus* (*McDonald KRM16860 & Thompson*, BRI).

Herbarium specimens and/or images of type specimens of all the other species of *Elionurus* and species in other genera of *Tripsacinae* and *Rottboelliinae* were examined in detail (**Appendices 1 & 2**).

Leaf and culm transverse sections were prepared using a modified freehand sectioning version of the method described by Frohlich (1984). Samples of herbarium material were rehydrated by initial immersion in hot water and left to soak for up to several days. Leaves from upper culms were used and sections taken from near the middle of each leaf. Leaf samples were placed on a glass slide covered with a glass slide cover that served as a cutting guide. Culm sections were cut without the use of the slide cover. Thin sections were cut using a razor blade while viewing under a binocular microscope at ×40 magnification. Several sections were made for both *E. purpureus* and *E. citreus*. Three accessions of *E. citreus* were examined to capture variation and because some leaf blades retained distorted parenchyma following rehydration. Leaf blades and culms of near equivalent width were used for both species.

Leaf, spatheole and culm surface replicas were prepared using the method described by Hilu & Randall (1984).

Micromorphology was studied from images taken using a compound binocular microscope at 5×, 10×, 20× and 40× for transverse sections, and at 20× and 40× for surface replicas.

Plants of *E. citreus* and *E. purpureus* were cultivated for three main purposes: to study any impact of environment on growth habit, effect of environment on the breeding system, and provide a supply of viable caryopses for further studies. Caryopses were taken from the type of *E. purpureus* and BRI accession, *McDonald KRM11354* for *E. citreus*. The caryopses were scarified by scraping off a small portion of pericarp just above the scutellum. Germination was at ambient temperature on damp tissue paper in a covered transparent container in November 2016.

Plants were cultivated in pots in a well-drained potting medium in full sun in Brisbane, Australia (lat. 27^0 26' 37''S). Plants were watered daily, unless there had been sufficient rain, to maintain continuously moist potting medium. Watering rate was at about 7 mm per day, measured using a rain gauge, equating to about 1000 mm for the wet season (December – March). Plants were occasionally fertilised with a commercial pelletised chicken manure.

Rainfall data from Climate Data Online (BoM) for weather stations near the collection localities of BRI accessions of *E. purpureus* were examined to investigate the potential effect of soil moisture levels on plant growth and flowering. Frequency of rainy days of more than 5 mm and more than 10 mm are recorded in **Table 2** as a comparison with the watering regime of cultivated plants.

Spikelets from the cultivated plants were examined in detail at flowering and fruiting in April – June 2017. Spikelets from the upper and lower halves of racemes were harvested on a daily basis as they matured. The most distal spikelet of racemes disarticulated readily at maturity. Ripe spikelets were gathered by gently touching. The proportion of CH:CL was examined by randomly selecting 20 spikelets for two batches, each batch from the upper halves and lower halves of racemes.

Botanical terminology follows Beentje (2010) and Harris & Harris (1994) for general usage. An exception is the use of the term *convexo-concave* to differentiate the shape of the culm transverse section of *E. purpureus*. Anatomy descriptions and terminology follow Metcalfe (1960), Ellis (1976, 1979), Renvoize (1982) and Watson & Dallwitz (1992).

Taxonomy

Key to the Australian species of *Elionurus*

1 Perennial; spikelets pallid to pale pink; sessile spikelet with lobes longer than body; body of lower glume pubescent; upper glume glabrous on margin; NE NSW, E Qld, N NT, N WA . . . . . **E. citreus**

1. Annual; spikelets purple at maturity; sessile spikelets with lobes shorter than body; body of lower glume pilose or glabrous; upper glume pilose on margin; N Qld . . . . . **E. purpureus**

Elionurus purpureus E.J.Thomps., **sp. nov.** similar to *E. citreus* (R.Br.) Munro ex Benth. differing by the annual growth habit and purple spikelets 8.1–9.1 mm long with body of lower glume longer than the lobes and margin of upper glume pilose. **Typus:** Queensland. Cook District: 0.8 km along Mt Spurgeon road from Mulligan Highway, Mt Carbine, 10 April 2015, *K.R.McDonald KRM16860 & E.J.Thompson* (holo: BRI).

Erect caespitose annual to 1.3 m high. Culms < 4 mm wide, shortly branched, nodes 3–9; internodes purplish, smooth, hairless, furrowed; nodes glabrous often purplish, half to two-thirds of total length exserted from sheath. Basal leaf sheaths purplish; culm sheaths with scattered white hairs mostly near apical margins; collar margins with hairs to 3.3 mm. Ligule a fringed membrane, *c.* 0.9 mm. Leaves cauline, blades up to 45 cm long and 0.8–2 mm wide, discolorous, cauline, keeled, pilose adaxially, hairs to 0.2 mm, margins smooth, inrolled on drying, lemon-scented when crushed. Inflorescences of single spatheolate one-sided racemes, 4 to 13 cm long. Peduncle absent. Up to 9 nodes with 1–3 one-noded branches each bearing a raceme; axillary racemes exserted, partly exserted or enclosed with spatheole; spatheoles *c.* 4.5 mm wide and up to 13 cm long, pilose; culms extending to 15 cm beyond spatheole. Spikelets paired (sessile and pedicellate), dimorphic, purple at maturity, closely overlapping in two opposing staggered rows along disarticulating jointed axis; diaspore composed of paired spikelets and rachilla. Callus elliptical, *c.* 0.4 × 1–2.3 mm. Sessile spikelet fertile, dorsi-ventrally compressed, 1.4–1.6 × 8.1–9.2 mm , gradational (larger from base to apex), proximal beak 2–2.2 mm long. Glumes dissimilar; lower glume 6.1–7.5 mm long; body 1.7–2 × 3.5–4.2 mm, broadest in middle, 9-veined, symmetrical, chartaceous; back flattened, pubescent with appressed pale hairs *c.* 0.2 mm long or sometimes glabrous; margins keeled, keels not winged, with two rows of pectinate white bristles to 1.3 mm long at 45° to margin decreasing in length towards apex, sub-margins with broad dark purple glabrous *oil streak* continuous with lobes; apex 2-lobed, 2.6–3.2 mm long, obtuse, lobes fused in lower third to half; upper glume 4.2–4.5 mm long, symmetrical, lanceolate, membranous, 3-veined, carinate, midvein with short erect proximal hairs; margins winged, wing *c.* 0.3 mm wide, membranous, pilose; short appressed to ascending hairs on back, glabrous in upper 1/3, apex acute. Florets 2; lower floret neuter, lemma *c.* 3.5 mm long, lanceolate, hyaline, veins indistinct, margin pilose, apex acute. Lower palea absent. Upper floret hermaphrodite, upper lemma, 2.5–2.8 mm long, elliptic, hyaline, veins indistinct, margin pilose, apex obtuse. Upper palea absent. Lodicules 2, *c.* 0.5 mm long. Anthers chasmogamous 3, 0.9–2 mm long, cream when fresh, or cleistogamous 3 and *c.* 0.8 mm long. Caryopses *c.* 1 × 0.6 × 2.5–2.7 mm, dorsiventrally compressed, broadest in the middle, bowed longitudinally, buff to light brown; scutellum *c.* 1.4 mm long; hilum *c.* 0.5 mm long. Pedicellate spikelet neuter; glumes dissimilar, subequal, 5-veined, chartaceous, lanceolate, lobes orientation parallel to body; lower glume 0.8–1.3 × 5.2–5.7 mm, dorsally compressed, back glabrous, asymmetrical, broadest at the base, acute apex; 1-lobed, lobe orientation horizontal; margin 1-keeled, with a single row of pectinate white bristles *c.* 0.6 mm long decreasing in length apically, submargins with *oil streak*; upper glume, *c.*

0.8 × 4.5–5.3 mm, glabrous, symmetrical, laterally compressed; back convex, carinate in upper half, keel pilose with stiff parallel hairs *c.* 0.2 mm long; apex acute; 1-lobed, lobe orientation vertical; margins flat. Pedicel *c.* 0.8 × 2.5–3.5 mm, free from internode, clavate, hollow, plano-convex in cross-section, adaxial wall membranous and abaxial wall chartaceous; abaxial edge pubescent with white hairs, short and appressed along most of length and with a longer sub-apically tuft to 2.4 mm. Rachilla 1.2–1.4 × 4.3–4.4 mm, dissimilar to pedicel, free from internode, clavate, hollow, plano-convex in cross-section, adaxial wall membranous and abaxial wall chartaceous, abaxial edge pubescent with short white appressed hairs; apex *c.* 1.2 × 2.3 mm, oblique, adaxially flanged, unequally bilobed, subapical ring of white hairs to 2.8–2.9 mm long and longest on abaxial margin; disarticulation scar *c.* 0.7 mm × 1.5 mm, flat, elliptical. **Figs. 1, 2, 3 & 4**.

***Additional specimens examined*: Queensland.** Cook District: 9 km from Koolburra on the track S from Koolburra to the Kimba road, Jun 1981, *Clarkson 3699* (BRI); Conglomerate Creek, S of the Deighton Road, on Escort Creek Holding, SE of Laura: Lot/Plan 198/SP273726, Apr 2017, *Forster PIF45151 & McDonald* (BRI, MEL); 0.8 km along Mt Spurgeon road from Mulligan Highway, Mt Carbine, May 2017, *Thompson EJT1083* (BRI). **Cultivated.** Ashgrove, Apr 2017, *Thompson MOR804* (BRI).

***Distribution and habitat*:** *Elionurus purpureus* occurs west of the Great Dividing Range in the range latitude 15°15' to 16°45'S and longitude 143°30' to 145°15'E (**Map 1**). It is found in woodland mostly dominated by eucalypts including *Corymbia clarksoniana* (D.J.Carr & S.G.M.Carr) K.D.Hill & L.A.S.Johnson, *Eucalyptus leptophleba* F.Muell. and *E. tetrodonta* F.Muell. on sandy alluvial soil adjacent to intermittent creeks or lagoons.

***Phenology*:** *Elionurus purpureus* flowers in March to June during the wet season and early dry season.

***Notes*:** The identification key to *Elionurus* species of the world provided by Renvoize (1978) was used to verify that *E. purpureus* is not an introduced species as specimens fail to key out satisfactorily. Using the key character *annual*, specimens key to *E. hensii* K.Schum from the African continent, although examination of the online image of the isosyntype provided confirmation of the dissimilarity with *E. hensii*. If the growth habit is assumed to be perennial then specimens key to *E. citreus* but do not have the *lower glume with lobes longer than the body*. **Table 3** lists the character differences between *E. purpureus* and *E. citreus* and **Fig. 4** provides images of the respective spikelet pairs for comparison.

Diaspore dispersal in the Australian species of *Elionurus* occurs via two modes. Most of the diaspores readily disarticulate from the racemes at maturity and can disperse by various vectors in similar ways to other grasses. Secondly, the basal spikelet pair that is CH or CL of each raceme is resistant to disarticulation. This delayed release of the spikelet may have some advantage with dispersal allowing the spikelet to fall further from the mother plant after the culms collapse.

Appendix 2 lists spikelet differences for all the species of *Elionurus*. This comparison shows that the Australian species exhibit morphological similarities between themselves but are distinct from the other species. Only the Australian species have the pedicellate spikelets composed of just the two glumes and they always neuter. The non-Australian species have developed pedicellate spikelets with two lemmas and anthers. This variation in development of the pedicellate spikelet within a genus is uncommon in *Andropogoneae* but has parallels in *Arthraxon* Beauv. (van Welzen 1981). Furthermore, the Australian species have a distinctive character of the sessile spikelets that they share with most of the other species. The lower glumes have conspicuous submargins that Clayton & Renvoize (1986) referred as a *brown oil streak* and Watson & Dallwitz (1992) called *glandular*. Three species, *Elionurus elegans* Kunth, *E. hirtifolius* Hack. and *E. royleanus* A.Rich. from Africa to NW India, lack this *oil streak*. These species differ by having tufts of hairs along the margins of the lower glume of the sessile spikelets instead of the row of parallel hairs present in the other species

Table 2. Categories of cleistogamy (CL) in Poaceae as presented by eight authors with those that apply to the Australian species of Elionurus shown in BOLD

Author	Taxonomic context of CL classification	Number of CL types recognised	Monomorphic anthers		Dimorphic anthers		
			CH = CL on the same plants	CL only	**Polymorphism** – CH and CL on separate plants	**Amphigamy** – CH and CL in two types of inflorescences in different parts of the same plant	**Anther dimorphism** or morphology not specified
Darwin (1877)	Angiosperms	2	**No structural peculiarities**	no category (Darwin doubted this possibility)	no category	no category	**Structural peculiarities** *true cleistogamy*
Hackel (1906)	Poaceae	4	Facultative CL (Group 1)	CL only (Group 3)	Dimorphic (Group 2)	Amphigamous (Group IV)	no category
Uphof 1938)	Angiosperms	2	Ecological CL	Constitutional CL	no category	no category	**Constitutional CL**
Connor (1979)	Poaceae	3	**CL and CH**	CL only	no category	Clandestine axillary (*cleistogenes*)	no category
Lord (1981)	Angiosperms	4	Preanthesis, pseudocleistogamy	Complete	no category	no category	**True**
Campbell *et al.* (1983)	Poaceae	4	**Type Ia. sheath fertilization (uppermost sheaths)Type IVb. spikelet fertilization (lodicule failure)**	no category	no category	Type II. cleistogenes, Type III. rhizanthogenes	**Type Ib. sheath fertilization (lowermost sheaths of culms)** Type IVa. spikelet fertilization (spikelet bract modifications)
Watson & Dallwitz (1992)	Poaceae	2	**Exposed-cleistogamous**	no category	no category	Hidden cleistogenes – very modified, highly modified	no category
Culley & Klooster (2007)	Angiosperms	3	Induced	Complete	no category	no category	**Dimorphic**

(see **Fig. 4**). However, the three species have similarities to the Australian species by the lower glume of the pedicellate spikelets being asymmetrical with the apex lobed or awned (**Appendix 2**).

Harvesting of ripe spikelets from the cultivated plants of *E. purpureus* to collect caryopses revealed a further character uncommonly represented on herbarium specimens. Spikelets on each raceme ripen and disarticulate successively until the basal one that is resistant to detachment from the culm but ultimately falls. The specimens of the species of *Elionurus* observed for this study frequently had over-mature racemes preventing observation of this phenomenon, although it was present on one specimen of *E. citreus* at BRI. The herbarium specimens usually had complete racemes and sometimes partially disarticulated ones. Permanent retention of the basal spikelet is uncommon in Australian *Andropogoneae* but has been reported by Veldkamp *et al.* (1986) and observed on herbarium specimens by the author for *Thaumastochloa* C.E.Hubb., also *Rottboelliinae*.

Very few of the caryopses obtained from BRI specimen accessions were viable. Several caryopses from the holotype of *E. purpureus* germinated and two plants survived to maturity. One caryopsis of *E. citreus* from *McDonald KRM11354* (BRI) germinated and the plant survived to maturity.

Observations from the cultivated progeny of *E. purpureus* revealed striking differences from the type that initially appeared to be the only collection. This promoted a review of the 148 accessions of *E. citreus* at BRI. One of the accessions, *Clarkson 3699,* matched the cultivated plants. At the point of nearing completion of this manuscript another specimen, *Forster PIF45151 & McDonald*, was incorporated at BRI. This accession is comprised of plants that are identical to the type in growth habit and inflorescence composition.

The difference in the growth habit of the type from its cultivated progeny was considerable. The plants comprising the type have single slender culms to 30 cm high while all cultivated plants had multiple culms, one main robust culm to 1.3 m high and up to 4 subordinate ones to 50 cm high. Cultivated plants had much larger leaves, to 6 mm wide × 42 cm long, compared to the type with leaves 1–2 mm wide × 18 cm long. All of the cultivated plants closely resembled BRI accession *Clarkson 3699* (**Fig. 2**).

There were also differences in the inflorescences of cultivated plants. The cultivated plants of *E. purpureus* had racemes to 13 cm long in fasciculate inflorescences comprised of up to three racemes on branches arising at as many as nine culm nodes. The holotype and accession *Forster PIF45151 & McDonald* have single racemes to 8 cm long on short branches at up to three nodes. The cultivated plant of *E. citreus* had single racemes at the nodes as was observed for the topotypes listed in **Appendix 1**.

The study of the wet season rainfall data presented in **Table 2** resulted in equivocal conclusions. The sample size is too small for any clear trends but there is some evidence to support a hypothesis that December rain of *c.* 100 mm may be responsible for plants developing the taller growth habit. This seems plausible since no intermediate sized plants were observed despite the presence of soil moisture gradients at least for some of the collection sites (pers. comm. P.I. Forster). The possibility of dimorphic growth habit requires further investigation, particularly from further field survey.

Breeding system

In order to categorise the CL found in *Elionurus*, the classification schemes of CL presented by eight authors were investigated. These schemes are of two broad types in terms of taxonomy, for flowering plants in general and more specifically for grasses. The classifications by Campbell *et al.* (1983) and Hackel (1906) provide more specific categories relevant to Poaceae. In summary, the schemes assess CL by the presence of various morphological modifications of the CH morph or whether CL is induced by environmental conditions. The categories

Fig. 2. Paratype of ***Elionurus purpureus*** (*Clarkson 3699*, BRI).

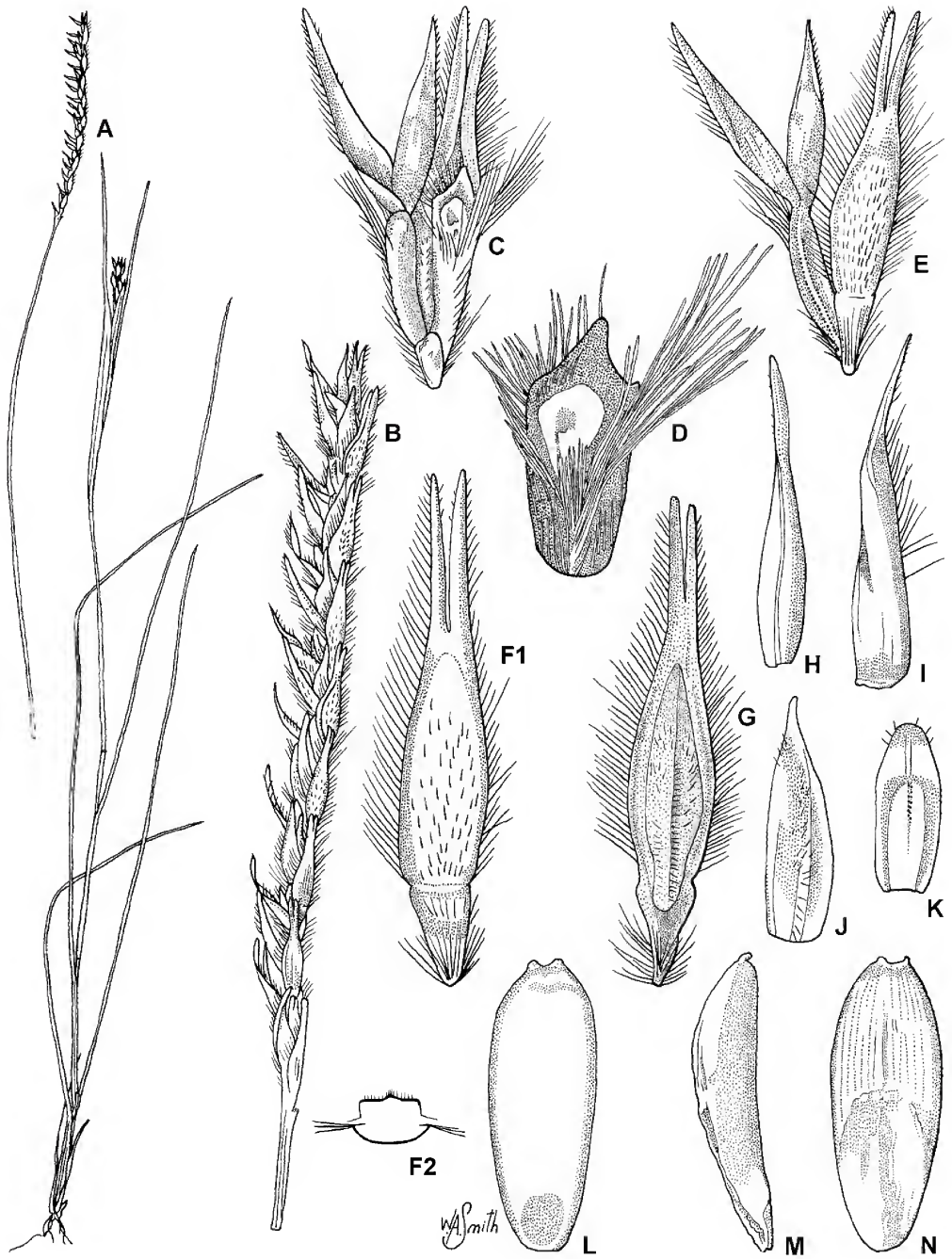

Fig. 3. ***Elionurus purpureus.*** A. growth habit ×0.5; B. terminal raceme ×2; C. adaxial view of diaspore ×6; D. apex of rachillas showing flange ×12; E. abaxial view of diaspore ×6; F1. lower glume of sessile spikelet ×8; F2. TS of lower and upper glumes at mid-point ×6; G. back of lower glume showing upper glume *in situ* ×8; H. upper glume of pedicellate spikelet ×8; I. lower glume of pedicellate spikelet ×8; J. lower lemma of sessile spikelet ×8; K. upper lemma of sessile spikelet ×8; L. back view of caryopsis ×16; M. side view of caryopsis ×16; N front view of caryopsis ×16. All from *McDonald KRM16860 & Thompson* (BRI). Del. W. Smith.

Fig. 4. Top: ***Elionurus purpureus***. front and back of diaspore from *McDonald KRM16860 & Thompson* (BRI). Bottom: ***E. citreus***. front and back of diaspore from *Halford QM342 & Bean* (BRI).

from these schemes that apply to the Australian species of *Elionurus* are shown in **Table 1**. Overall these categories help define the expression of CL in the Australian species of *Elionurus* but none of the individual schemes provides a comprehensive classification alone. *E. purpureus* has a mixed breeding system consisting of CH and CL morphs with dimorphic anthers. Racemes can be mixed CH and CL and solely CL on the same plants as observed on cultivated plants. Racemes with CL spikelets can occur from the lowest to the upper most nodes. Also, plants can be solely CL as for the type specimen.

Racemes can occur on elongated branches with spikelets fully exposed or racemes can be partially retained within spatheoles or leaf sheaths. This provides two dispersal mechanisms or at least differential release of spikelets. Exposed CL and CH spikelets can disperse in the usual way as for most grasses whereas the retained CL spikelets are likely to remain close to the mother plant after collapse of the culms.

Random selections of spikelets gathered from a single cultivated plant revealed spikelets from:

a. the upper half of racemes – 40–50% CL, 40–50% CH and 10% empty.

b. the lower half of racemes – 30–70% CL, 20–60% CH and 10% empty.

From this small sample it appears that the ratio of CL:CH is more variable in the lower half of racemes. Further sampling is required to determine if the CL:CH ratio varies with position of the raceme on plants and maturation of plants. Racemes develop sequentially on plants such that the fasciculate inflorescences have as many age groups of racemes as there are racemes. Age groups of racemes on cultivated plants differed by

Table 3. Monthly rainfall data (mm) from two Queensland weather stations near the three collection locations of *Elionurus purpureus* for the wet season covering the date of the collection. N - number of days with rain exceeding 5 and (10) mm

Rainfall station	Accession	Plant growth habit	Wet Season Year		D	J	F	M	Total
Mt Carbine Township	*McDonald & Thompson KRM16860* (April 2015)	small plants with a single slender culm	Mean (mm)		120	206	225	178	730
			2014–15	mm	30	132	122	121	405
				N	1 (1)	7 (5)	7 (6)	6 (3)	21 (15)
	(April 2016)	no plants observed	2015–16	mm	262	97	68	144	571
				N	9 (7)	4 (3)	3 (2)	3 (2)	19 (14)
	Thompson EJT1083 (May 2017)	small plants with a single slender culm	2016–17	mm	40	383	293	131	847
				N	2 (1)	14 (11)	9 (5)	7 (4)	32 (21)
Laura PO	*Clarkson 3699* (June 1981)	tall plants with multiple robust culms	Mean (mm)		149	234	247	177	807
			1980–81	mm	100	442	520	103	1165
				N	6 (4)	19 (14)	18 (15)	4 (2) [0]	47 (35)
	Forster PIF45151 & McDonald (April 2017)	small plants with a single slender culm	2016–17	mm	27	440	238	217	922
				N	2 (1)	13 (9)	16 (8)	9 (7)	40 (25)

about two weeks in their maturity. From this study, the evidence suggests that the presence of CL is not environmentally induced but the ratio of CL:CH may increase with increasing moisture stress.

E. citreus also has a mixed breeding system similar to *E. purpureus*. Furthermore, one specimen of *E. citreus* that lacked CH had dimorphic spikelets with CL anthers, *c.* 0.6 and 1.2 mm long, respectively compared to the CH, 1.3 to 2.7 mm from other specimens examined. The latter occurrence may be explained in terms of spikelets that potentially would be CH but because of lodicule failure induced by environmental conditions did not open. Spikelets with monomorphic CL anthers were not observed for *E. purpureus*.

The occurrence of CL in the non-Australian species of *Elionurus* requires further research.

Anatomy

Anatomical differences between the two Australian species of *Elionurus* are presented in **Table 3**. Descriptions of anatomy of leaf blade TS and surface, and culm TS for *E. purpureus* are as follows:

Adaxial leaf blade epidermis: Costal/intercostal zonation evident. Long-cells markedly different in shape costally and intercostally, the costals much narrower, sinuous. Intercostal short cell sinuous, uncommon. Papillae absent. Bicellular microhairs present, uncommon, panicoid-type, *c.* 3 µm wide at septum, 60–67 µm long; apical cell length/total length ratio 0.6–0.7. Stomata with parallel-sided subsidiary cells, one row, *c.* 8/mm, 45–60 µm long. Intercostal silica bodies dumb-bell shaped, 15–20 µm long. **Figs. 5A & B**.

Transverse section of leaf blade: C4: XyMS +. Mesophyll with indistinctly radiate chlorenchyma with columns of clear cells between vascular bundles. Bulliform cells continuous with constant size, not in discrete adaxial groups over vascular bundles. Midrib conspicuous, keeled, rounded; adaxial clear cells above bundle sheath; bundle sheaths with single arcs of sheath cells with chloroplasts bordered by a single row of indistinctly radiate chlorenchyma. Three orders of vascular bundles; primaries and secondaries with a single layer of bundle sheath cells with even outline, interrupted adaxially by air cells only, sclerenchyma absent, and abaxially by girder of sclerenchyma; tertiaries bundle sheath a ring without girder of sclerenchyma. Blade tip with sclerenchyma 1 or 2 cells thick. **Figs. 6A & B**.

Transverse section of culm: asymmetrical, bread-loaf shaped. Chlorenchyma lacking. Pith present. Sclerenchyma a continuous peripheral band mostly 2 or 3 cells wide, larger cells on concave surface. Vascular bundles of three types: small marginal, medium-sized sub-marginal and large extramarginal, the latter separated from the sclerenchyma by one layer of large clear cells. **Figs. 7A & B**.

***Etymology*:** The specific epithet *purpureus* is in reference to the distinctive dark purple spikelets that make the plants of this species very conspicuous in the field.

***Conservation status*:** *Elionurus purpureus* is known from three locations and is considered to have a **Vulnerable** conservation status based on criterion B2a (IUCN 2001).

Elionurus characters and affinities

This study revealed some morphological characters that help distinguish *Elionurus* from other genera of *Andropogoneae* with awnless lemmas. These characters are additional to those presented in studies by Clayton (1973), Renvoize (1978), and Watson & Dallwitz (1992). All species of *Elionurus* have the sessile spikelets with a distinctive beak below the lower glume (see **Figs. 3E & F**). The Australian species of *Elionurus* have inflated chartaceous rachillas and pedicels differing from the other species that have cartilaginous, slender to slightly inflated rachillas. *E. purpureus* and usually *E. citreus* differ from the other species by the rachillas having a distal asymmetrical bilobed flange (see **Fig. 3D**). In a study of morphological characters of *Rottboelliinae*, Clayton (1973) referred to this flange as an *internode tip with membranous rim* but he did not indicate which species had this character.

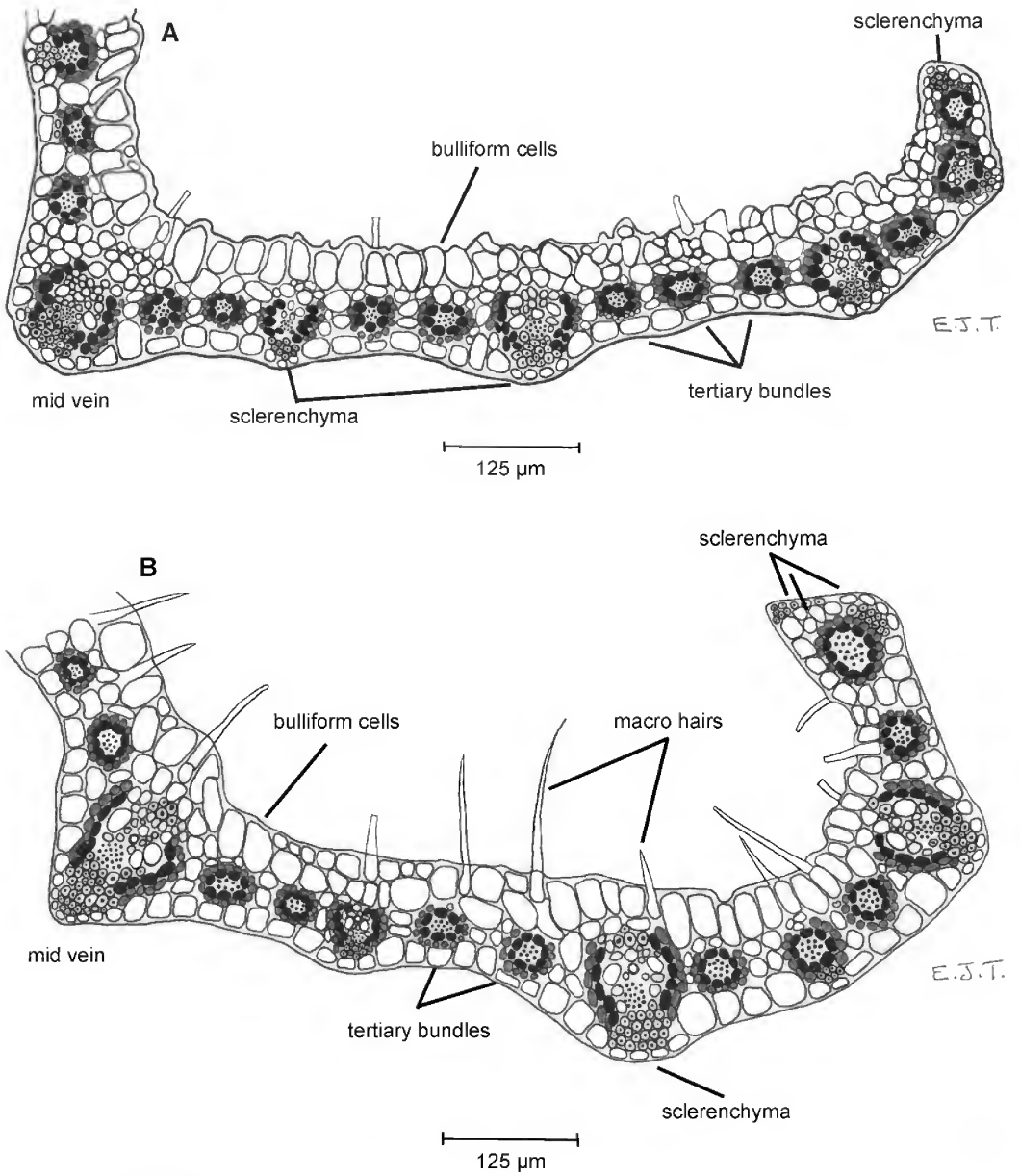

Fig. 5. A. ***Elionurus purpureus.*** transverse section of half of leaf blade. B. ***E. citreus***. transverse section of half of leaf blade; A from *McDonald KRM16860 & Thompson* (BRI); B from *Halford QM342 & Bean* (BRI). Del. E.J.Thompson.

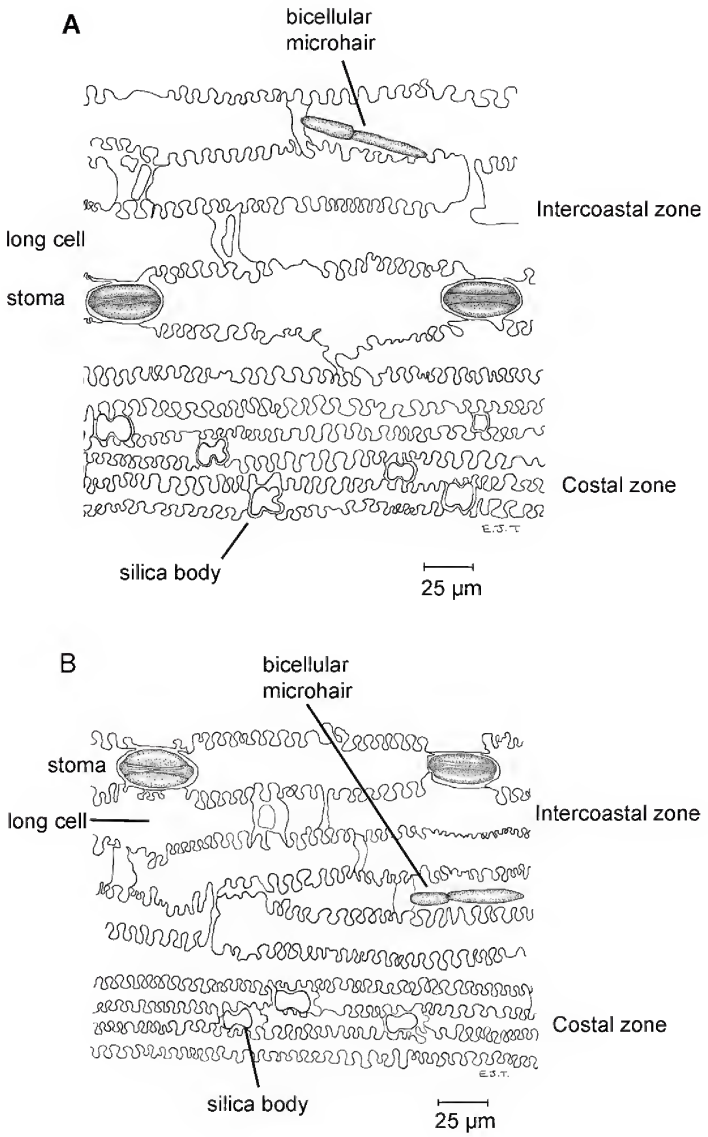

Fig. 6. A. ***Elionurus purpureus***. abaxial leaf blade epidermis. B**. *E. citreus***. abaxial leaf blade epidermis. A from *McDonald KRM16860 & Thompson* (BRI); B from *Everist s.n.* (BRI [AQ286391]). Del. E.J.Thompson.

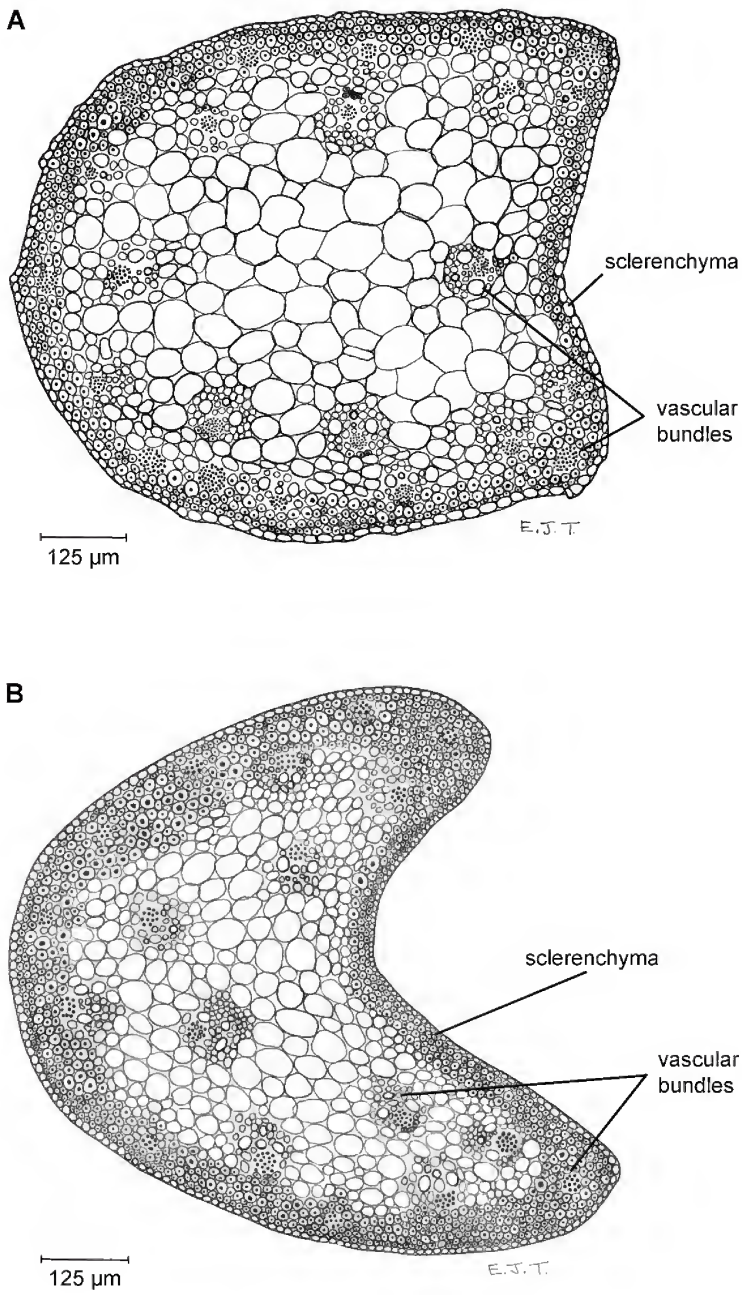

Fig. 7. A. ***Elionurus purpureus***. transverse section of culm. B. ***E. citreus***. transverse section of culm. A from *McDonald KRM16860 & Thompson* (BRI); B from *Everist s.n.* (BRI [AQ286391]). Del. E.J.Thompson.

Three other genera within *Tripsacinae* and *Rottboellinae*, *viz. Eremochloa* Buse, *Loxodera* Launert and *Urelytrum* Hackel, have morphological affinities to *Elionurus* (Clayton 1973) although Kellogg (2015) placed *Urelytrum* in subtribe *Tripsacinae*. *Eremochloa* occurs in Australia and Asia, while *Loxodera* and *Urelytrum* are from Africa (Watson & Dallwitz 1992). The lower glume of the sessile spikelet and the pedicel of the pedicellate spikelet of *Elionurus*, *Eremochloa* and *Loxodera* are chartaceous to slightly hardened, while for most other species of *Rottboelliinae* these structures are crustaceous. Additionally *Elionurus*, *Eremochloa* and *Loxodera* have free pedicels, whereas commonly in *Tripsacinae* and *Rottboelliinae* species have the pedicels fused to the rachillas.

A notable variation in the genera of *Tripsacinae* and *Rottboelliinae* is the margins of the lower glume of the sessile spikelets that have a row of trichomes which can be viewed as a continuum of different types, *viz.* bristles, prickles, setae, spicules, tubercles or glabrous. *Eremochloa* has a row of tough bristles or setae (Buitenhuis & Veldkamp 2001), *Jardinia* Benth. & Hook.f. has pectinate spicules, *Elionurus* has tufts of hairs or stiff hairs, *Urelytrum* has a row of bristles and *Loxodera* has a scabrid margin (**Appendix 3**).

Observations from herbarium specimens for this study revealed that *Urelytrum* has close morphological affinity to *Elionurus*. *Urelytrum* is the only other genus of *Tripsacinae* and *Rottboelliinae* to have species with a proximal beak on the lower glume and a distal asymmetrical flange on the rachillas. However, *Urelytrum* differs from *Elionurus* by the sessile spikelets being embedded into crustaceous rachillas. Other genera in subtribes of *Andropogoneae* including *Chrysopogon* Trin. (*incertae sedis*), *Sarga* Ewart (subtribe *Sorghinae*) and *Schizachyrium* Nees (subtribe *Andropogoninae*) (Soreng *et al.* 2015) also have a proximal beak although these genera have the upper lemmas of the sessile spikelets with geniculate spiralled awns. Also, *Urelytrum* has similarities to many of the non-Australian species of *Elionurus* by the pedicellate spikelets being male and lacking lobes. Conversely, *Urelytrum* has affinities with the Australian species of *Elionurus* by the dissimilarities of the paired spikelets and characters of the pedicellate spikelets including the lower glume being asymmetrical with one of the margins being keeled, and upper glume laterally compressed.

The type of inflorescence exhibited by the cultivated plants of *E. purpureus* has similarities to that found in some other Australian *Rottboelliinae*. Watson & Dallwitz (1992) described the inflorescences of *Elionurus* as "spatheolate; *a complex of 'partial inflorescences' and intervening foliar organs*". It is described here as: single spatheolate racemes on up to three nodeless or one-noded elongated branches emanating from several culm nodes. Veldkamp *et al.* (1986) referred to this type of inflorescence as fasciculate and Sharp & Simon (2002) referred to it as a synflorescence. The racemes develop sequentially and herbarium specimens display this by usually having the branches of unequal length bearing youngest racemes on the shortest branches. Such inflorescences occur in *Ophiuros* Gaertn.f. and some species of *Mnesithea* Kunth.

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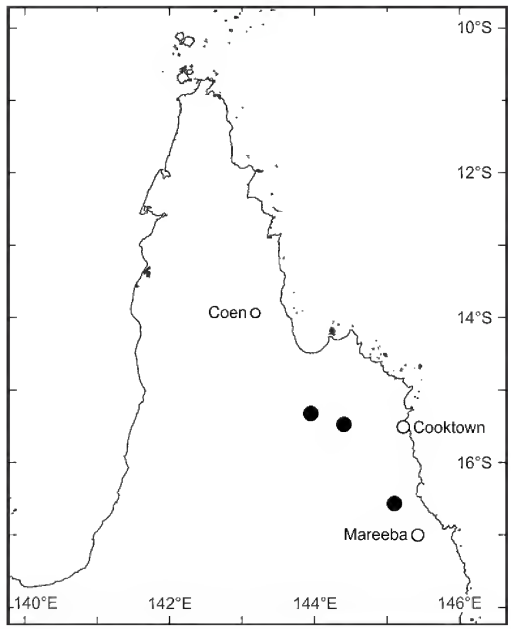

Map 1. Distribution of *Elionurus purpureus*

Appendix 1. List of topotypes for *Elionurus citreus*

Port Curtis District: Middle Percy Island, *s.dat.*, *Tryon s.n.* (BRI [AQ286398]); Bruce Highway, opp. Mt Colosseum, Jun 1962, *Tothill H323* (BRI); Just S of Round Hill Head on Island side of Peninsula, Mar 1970, *Everist s.n.* (BRI [AQ286391]); Rocky Shelf Bay, South Percy Island; 50 km NE of Arthur Point, Shoalwater Bay, Oct 1989, *Batianoff 11438* (BRI); Smiths Bluff, South Percy Island, Oct 1989, *Batianoff 11333* (BRI); Shoalwater Bay training Area, Razorback sector, 350m S from East West Road, Apr 2011, *Halford QM342 & Bean* (BRI).

Appendix 2. Spikelet differences between the species of *Elionurus*

Species	Paired spikelet likeness*	Sessile spikelets			Pedicellate spikelets				
		LG margin hairs	LG sub-margins	LG apex	Floret	LG symmetry	LG sub-margins	LG margins	LG apex
E. barbiculmis Hack.	similar	pectinate	*oil streak*	acute	male	symmetrical	*oil streak*	2-keeled	acute
E. bilinguis (Trin.) Hack.	similar	pectinate	*oil streak*	2-awned	male	symmetrical	*oil streak*	2-keeled	1-awned
E. ciliaris Kunth	similar	pectinate	*oil streak*	acute to 2-toothed	male	symmetrical	*oil streak*	2-keeled	acute
E. citreus (R.Br.) Munro & Benth.	dissimilar	pectinate	*oil streak*	attenuate 2-lobed	empty	asymmetrical	*oil streak* on one margin	1-keeled	attenuate 1-lobed
E. elegans Kunth	dissimilar	tufted	*oil streak absent*	2-awned	male	symmetrical	*oil streak absent*	1-keeled	1-awned
E. euchaetus Adjanohoun & Clayton	dissimilar	pectinate	*oil streak*	2-awned	male	symmetrical	*oil streak*	1-keeled	1-awned
E. hensii K. Schum.	dissimilar	pectinate	*oil streak*	attenuate 2-lobed	male	symmetrical	*oil streak*	2-keeled	attenuate 1-lobed
E. hirtifolius Hack.	dissimilar	tufted	*oil streak absent*	2-awned	male	asymmetrical	*oil streak absent*	1-keeled	1-awned
E. lividus Hack.	similar	pectinate	*oil streak*	acute	male	symmetrical	*oil streak*	2-keeled	acute
E. muticus (Spreng.) Kunth	similar	pectinate	*oil streak*	attenuate 2-lobed	male	symmetrical	*oil streak*	2-keeled	attenuate 1-lobed
E. planifolius Renvoize	similar	pectinate	*oil streak*	acute	male	symmetrical	*oil streak*	2-keeled	acute
E. platypus (Trin.) Hack.	similar	pectinate	*oil streak*	acute	male	asymmetrical	*oil streak*	2-keeled	acute
E. purpureus E.J.Thomps.	dissimilar	pectinate	*oil streak*	2-lobed	empty	asymmetrical	*oil streak*	1-keeled	acute 1-lobed
E. royleanus A.Rich.	dissimilar	tufted	*oil streak absent*	attenuate 2-lobed	male	asymmetrical	*oil streak absent*	1-keeled	attenuate 1-lobed
E. tripsacoides Willd.	dissimilar	pectinate	*oil streak*	2-lobed	male	symmetrical	*oil streak*	2-keeled	acute
E. tristis Hack.	similar	pectinate	*oil streak*	acute	male	symmetrical	*oil streak*	2-keeled	acute

* likeness in respect to shape and/or type of indumentum; there is usually some difference in size.

Appendix 3. Some variation in diaspores and types of trichomes on the margin of the lower glume of species from subtribes *Tripsacinae* and *Roettboelliinae*. Species without sessile spikelet imbedded in rachilla.

Fig. A3.1. *Elionurus hirtifolius* (*Harris 3098 & Fay*, MO) (*Tripsacinae*). Diaspore composed of sessile spikelet, developed pedicellate spikelet and rachilla.

Fig. A3.2. *Elionurus hirtifolius* (*Harris 3098 & Fay*, MO) (*Tripsacinae*). Trichomes on margin of lower glume – pectinate tuberculate-based tufts of bristles, submargin lacks *oil streak*.

Fig. A3.3. *Elionurus purpureus* (*Thompson, MOR804* BRI) (*Tripsacinae*). Diaspore composed of sessile spikelet, reduced pedicellate spikelet and rachilla.

Fig. A3.4. *Elionurus purpureus* (*Thompson, MOR804* BRI) (*Tripsacinae*).Trichomes on margin of lower glume – pectinate bristles; submargin with *oil streak*.

Fig. A3.5. *Eremochloa ciliaris* (*Clarkson 7793*, BRI) (*Rottboelliinae*). Diaspore composed of sessile spikelet, pedicellate spikelet absent and rachilla.

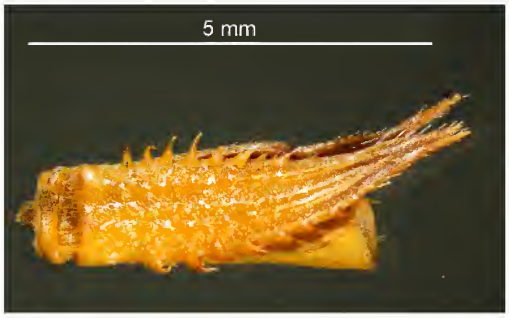

Fig. A3.7. *Jardinea gabonensis* (*Alsers 68*, MO) (*Rottboelliinae*). Diaspore composed of sessile spikelet, reduced pedicellate spikelet and rachilla.

Fig. A3.9. *Loxodera caespitosa* (*Mwasumbi 13796*, MO) (*Rottboelliinae).* Diaspore composed of sessile spikelet, developed pedicellate spikelet and rachilla.

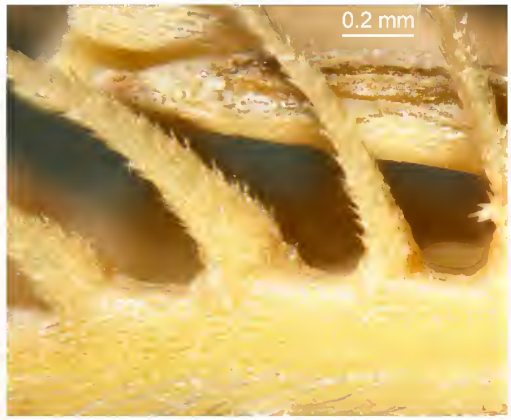

Fig. A3.6. *Eremochloa ciliaris* (*Clarkson 7793*, BRI) (*Rottboelliinae*). Trichomes on margin of lower glume – pectinate scabridous setae.

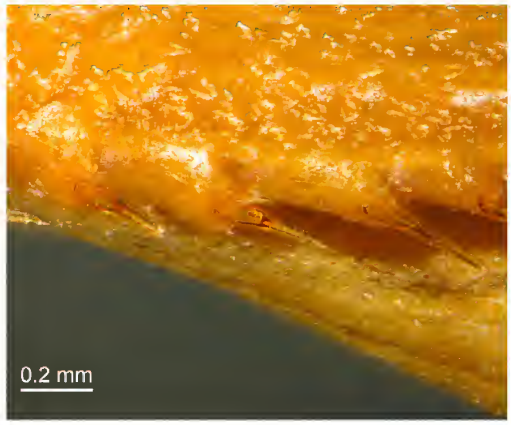

Fig. A3.8. *Jardinea gabonensis* (*Alsers 68*, MO) (*Rottboelliinae*). Trichomes on margin of lower glume – pectinate tuberculate-based spicules; tubercles sometimes with additional small bristles.

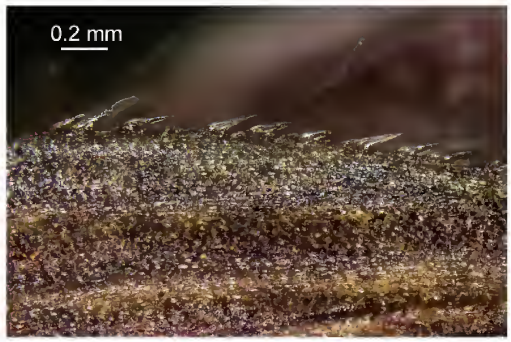

Fig. A3.10. *Loxodera caespitosa* (*Mwasumbi 13796*, MO) (*Rottboelliinae).* Trichomes on margin of lower glume – prickle hairs.

Fig. A3. 11. *Urelytrum agropyroides* (*Bidgood 5110,* MO) (*Tripsacinae*). Diaspore composed of sessile spikelet, reduced pedicellate spikelet with conspicuous elongated awn (only the base of the awn shown here), and rachilla.

Fig. A3. 12. *Urelytrum agropyroides* (*Bidgood 5110,* MO) (*Tripsacinae*). RHS: Trichomes on margin of lower glume margin – pectinate spicules.

Typifications in Australian Euphorbiaceae, Phyllanthaceae and Picrodendraceae

Paul I. Forster & David A. Halford

Summary

Forster, P.I. & Halford, D.A. (2017). Typifications in Australian Euphorbiaceae, Phyllanthaceae and Picrodendraceae. ***Austrobaileya* 10(1): 163–167.** Lectotypes are selected for *Amanoa dallachyana* Baill., *Antidesma sinuatum* Benth., *Antidesma parvifolium* F.Muell., *Echinus dallachyanus* Baill., *Euphorbia boöphthona* C.A.Gardner, *Euphorbia eremophila* var. *latifolia* Boiss., *Excoecaria agallocha* var. *dallachyana* Baill., *Lebidiera cunninghamii* Müll.Arg., *Macaranga subdentata* Benth., *Micrantheum boroniaceum* F.Muell., *Micrantheum demissum* F.Muell., *Micrantheum ericoides* Desf. and *Micrantheum hexandrum* Hook.f.

Key Words: Euphorbiaceae, Phyllanthaceae, Picrodendraceae, Typification, Australia flora, *Amanoa*, *Antidesma*, *Echinus*, *Euphorbia*, *Excoecaria*, *Lebidiera*, *Macaranga*, *Micrantheum*

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Introduction

Several typifications were prepared for publication in the *Flora of Australia* treatment of Euphorbiaceae *s. lat.* Due to significant delays in publication, and recently a shift to online publication, these typifications are presented here.

Taxonomy

ANTIDESMA (Phyllanthaceae)

P.I.Forster

1. Antidesma parvifolium Thwaites & F.Muell., *Fragm.* 4: 86 (1864). **Type:** [Queensland. North Kennedy District:] Port Denison, *s.dat.*, *E.F.A. Fitzalan s.n.* [in fruit] (lecto [here designated]: MEL 515970; isolecto: MEL 515968, MEL 515969, MEL 515971, MEL 515975).

Syntypes: [Queensland. North Kennedy District:] Port Denison, *s.dat.*, *E.F.A. Fitzalan s.n.* [in flower & some young fruit] (syn: K 000061635, MEL 251036, MEL 251037, MEL 251054, MEL 515973, MEL 515974).

***Notes*:** Mueller (1864) gave in his protologue "Ad sinum Edgecombe Bay juxta portum Denisonii; Fitzalan." All of the specimens cited here agree with the protologue, are attributed to Fitzlan and collected from Port Denison. The flowering and fruiting specimens are assumed to represent separate collections. All may represent separately mounted pieces of the original syntypes; however, MEL515970 (fruiting) is the best specimen and is selected as lectotype of the name.

2. *Antidesma sinuatum* Benth., *Fl. Austral.* 6: 87 (1873). **Type:** [Queensland. Cook District:] Saltwater Creek [Meunga Creek], Rockingham Bay, January 1863, *J. Dallachy 33* (lecto [here designated]: MEL 515944; isolecto: MEL 515943). (= **Antidesma bunius** (L.) Spreng.)

Syntypes: [Queensland. Cook District:] Rockingham Bay, *s.dat.*, *J. Dallachy s.n.* (syn: K 000061640, MEL 515940, MEL 515941); Meunga Creek, Rockingham Bay, 25 January 1869, *J. Dallachy s.n.* (syn: MEL 515942).

***Notes*:** Bentham (1873) cited simply "Rockingham Bay, *Dallachy*". There are collections at K and MEL that agree with the protologue and are eligible as types of this name. All were probably collected by Dallachy; however, the dates of collection

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differ and some have more data as to locality, i.e. 'Saltwater Creek, Rockingham Bay' or just 'Rockingham Bay'. All these collections have the sinuate leaves for which the species was named, all are conspecific with *A. bunius*. *A. sinuatum* is lectotypified here with MEL 515944. The label on MEL 515943 has the number '33' on the reverse.

CLEISTANTHUS (Phyllanthaceae)

P.I.Forster

1. Cleistanthus cunninghamii (Müll. Arg.) Müll.Arg. in A.DC., *Prodr. Syst. Nat. Regni Veg.* 15(2): 506 (1866); *Lebidiera cunninghamii* Müll.Arg., *Linnaea* 32: 80 (1863). **Type:** 'Nouvelle Hollande' [received] 1836, *A. Cunningham 31* (lecto [here designated]: G-DC G00319207); [Queensland. Moreton District:] Banks of the Brisbane [River], Moreton Bay, June–July 1829, *A. Cunningham 31* (isolecto: BM, *n.v.*; K 001081634, *p.p.*, image seen; NSW 193006).

Syntypes: 'Nouvelle Hollande', 1828 [received 1836], *A. Cunningham 120*; (syn: G-DC G00319206); [Queensland. Moreton District:] Brisbane River, 1828, *A. Cunningham 120/1828* (syn: K 001081634, *p.p.*, image seen; K 001081635, image seen); 'N.S.W.', Moreton Bay, 1828 [received 1836], *A. Cunningham s.n.* (syn: G-DC G00319208, 3 sheets).

***Notes*:** The two specimens in G-DC both have the same kind of label with the same location and date in the same script. It appears these are labels added when the specimens were received in 1836. Cunningham's original field numbers are also attached, allowing original collection dates to be established, and the matching of the specimens at G with duplicates at K and NSW. The specimen at NSW is apparently a duplicate of material at BM, but no material at BM has been located. A single sheet at K has elements from both *Cunningham 120/1828* and *31/1829*, but which number matches which piece(s) cannot be ascertained.

2. Cleistanthus dallachyanus (Baill.) Benth., *Fl. Austral.* 6: 122 (1873); *Amanoa dallachyana* Baill., *Adansonia* 6: 335 (1866). **Type:** [Queensland. Port Curtis District:] Rockhampton, *A. Thozet 357* (lecto [here designated]: MEL 707908).

Syntypes: [Queensland. Port Curtis District:] Stony Creek, Rockhampton, Qld, 24 December 1862, *J. Dallachy 17* (syn: K 001081629 image seen, MEL 708138); [Queensland. North Kennedy District:] Port Denison, *s.dat.*, *J. Dallachy s.n.* (MEL 707905); [Queensland. South Kennedy District:] Mount Mueller [Millar], 11 September 1863, *J. Dallachy s.n.* (MEL 707910).

***Notes*:** Baillon (1866) cited "Dallachy (1862), n. 17, Rockhampton (1863); Mount Mueller; Port Denison. – Thozet, n. 337, Rockhampton (herb. F. Muell.!)." Four sheets were located at MEL that correspond to these locations and collectors and agree with the protologue. The collection by Thozet has several branchlets and is in flower, so it is here designated as the lectotype. Thozet's collection number appears to have been incorrectly transcribed by Baillon as it is clearly 357 on the sheet at MEL.

EXCOECARIA (Euphorbiaceae)

P.I.Forster

Excoecaria dallachyana (Baill.) Benth., *Fl. Austral.* 6: 153 (1873); *Excoecaria agallocha* var. *dallachyana* Baill., *Adansonia* 6: 324 (1866). **Type:** [Queensland. Port Curtis District:] W side of River [Probably Fitzroy River, Rockhampton area], 29 January 1863, *J. Dallachy 248* (lecto [here designated]: MEL 705386 [sheet 1 of 2]; MEL 705387 [sheet 2 of 2]; isolecto: P 00716776, *p.p.*, image seen).

Syntype: Queensland, in [18]62, *E.M. Bowman 162* (syn: MEL 705388).

***Notes*:** There are several sheets at MEL that are possible types for this name. The name is typified with the numbered, fertile Dallachy collection, the first sheet of which bears diagnostic notes on the new taxon and agrees with the protologue. The lectotype is clearly labelled as a single collection mounted on two sheets, the current mounting having been prepared relatively recently, and certainly post-publication of the name. The sheet at P

is obviously original material, but it consists of a leafless branchlet, with six leaves, two fruit and an old flower in a packet, and the label states that the sheet is a mixed collection from *Dallachy 248* and *Bowman 142*, most likely representing portions removed from the sheets at MEL. The location of 'Rockingham Bay' on the label at P is probably somewhat erroneous as the species is not known that far north. Dallachy may have grouped it with his collections from the Rockingham Bay area. Another possibility is that the label may have been intended to be 'Rockhampton'.

MACARANGA (Euphorbiaceae)

P.I.Forster

1. Macaranga dallachyana (Baill.) Airy Shaw, *Kew Bull.* 23: 90 (1969); *Echinus dallachyanus* Baill., *Adansonia* 6: 314 (1866). **Type:** [Queensland. Cook District:] Rockingham Bay, Salt Water Creek [Meunga Creek], 3 March 1865, *J. Dallachy s.n.* (lecto [here designated]: MEL 707973; isolecto: MEL 707976).

Syntypes: [Queensland. Cook District:] Rockingham Bay, [received] 1872, *J. Dallachy s.n.* (syn: K 001067255, K 001067256); Rockingham Bay, Salt Water Creek [Meunga Creek], 16 December 1864, *J. Dallachy s.n.* (syn: MEL 707974); Rockingham Bay, *s.dat.*, *J. Dallachy s.n.* (syn: MEL 515964, MEL 515965).

***Notes*:** Baillon (1866) cited specimens examined as; 'Dallachy (1865), Rockingham's Bay, "salt water creeks" (herb F.Muell.!)'. Two of the MEL sheets have 'salt water creek 1865', written in Dallachy's handwriting and eight sheets have Rockingham's Bay written by another hand (probably Mueller's). The lectotype was chosen as the best of the two that have labels that were dated and written in Dallachy's hand and that agree with the protologue.

2. Macaranga subdentata Benth., *Fl. Austral.* 6: 145 (1873). **Type:** [Queensland.] Telegraph Line, Rockingham Bay, 2 November 1870, *J. Dallachy s.n.* (lecto [here designated]: MEL 515927; isolecto: MEL 515925, MEL 515926); **Syntypes:** [Queensland.] [Rockingham] Bay, [received] 1872, *J. Dallachy s.n.* (syn: K 001067257, K 001067258, K 001067259); Telegraph Line, Rockingham Bay, 23 January 1871, *J. Dallachy s.n.* (syn: MEL 232442).

***Notes*:** There are at least seven sheets identified as type material of this name at K and MEL. The sheet with a dated, fertile collection at MEL that agrees with the protologue is chosen as the lectotype, rather than the undated material at K.

EUPHORBIA (Euphorbiaceae)

D.A.Halford

1. Euphorbia boöphthona C.A.Gardner, *J. Roy. Soc. W. Australia* 27: 181 (1942). **Type:** Western Australia. Jimba Jimba [Station], Gascoyne River, 3 September 1932, *C.A. Gardner & F.J.S. Weir s.n.* (lecto [here designated]: PERTH 1618083; isolecto: PERTH 1618091).

***Notes*:** Gardner (1942) clearly indicates the type of *E. boöphthona* to be "Jimba Jimba ad fluminen Gascoyne River, Gardner n. 3302". A specimen with this number and locality has not been located. There are two PERTH sheets of material collected by Gardner from Jimba Jimba, Gascoyne River that predate the protologue. One sheet (PERTH 1618083) is labelled *E. boöphthona* in Gardner's hand. This sheet is chosen as the lectotype.

2. *Euphorbia eremophila* var. *latifolia* Boiss., *in* A.DC., *Prodr.* 15(2): 70 (1862). **Type:** [Queensland. Moreton District:] islands of Moreton Bay, August 1855, *F.Mueller* (lecto [here designated]: K 001080206 image seen [and K 001040200 image seen]; isolecto: MEL 503407 image seen). (= **Euphorbia tannensis** Spreng. subsp. **tannensis**)

Syntype: [Western Australia.] Intercourse Islands, Dampier Archipelago, in 1819, *A.C.* [*A.Cunningham s.n.*] (syn: K 001080207 image seen, K 001080208 image seen).

***Notes*:** In describing this variety Boissier (1862) cites two collections, "Ad Moreton Bay (Müll.!), Intercourse Island Archip. Dampier (h. Kew!)". The Mueller specimen at K is chosen as the lectotype as the material agrees

with the description in the protologue and it is the more ample of the collections. D.J. McGillivray annotated the sheet at K in 1969, adding a pencil line between the two branches on the sheet; however, both are from a single collection as evidenced by the single label on the sheet and there is no reason to separate the elements. Two barcode numbers have been added to the sheet to represent the two elements. The entire sheet is accepted as the lectotype. The *A.Cunningham* collections (K 001080207 and K 001080208) are conspecific with *E. tannensis* subsp. *eremophila* (A.Cunn.) D.C.Hassall.

MICRANTHEUM (Picrodendraceae)

D.A.Halford

1. *Micrantheum boroniaceum* F.Muell., *Fragm.* 1: 32 (1858). **Type:** [Queensland. Burnett District:] Burnett, *s.dat.*, *Dr M.* [*F.Mueller*] (lecto [here designated]: K 000950775 (ex herb. Hook.); possible isolecto: MEL 2065887, MEL 2065890). (= **Micrantheum ericoides** Desf.)

***Notes*:** Mueller (1858) cited two localities when describing this species: Burnett and Brisbane River, with the names Hill and Mueller, suggesting collections made by Walter Hill and himself. The Burnett River collection is the only one that has been located. Two sheets at MEL both have a label in Mueller's hand 'Burnett River, *Micrantheum ericoides*', and another sheet at K has the label '*Micrantheum boroniaceum* ferd Muell., Burnett Dr M.' also in Mueller's hand. The K specimen, the only collection found that is annotated by Mueller with this name, is nominated here as lectotype. A sheet at HBG (HBG 515896 image seen) is possibly a syntype, but the only location given is 'Australia'.

2. Micrantheum demissum F.Muell., *Vict. Naturalist* 7(5): 67 (1890). **Type:** [South Australia.] St Vincent Gulf, Square Waterhole, 6 & 7 January 1882, [*J.G.O.*] *Tepper 44* (lecto [here designated]: MEL 2065933; isolecto: K 000950764 image seen).

Syntypes: [South Australia.] Near Eleanor River, Kangaroo Island, 23 January 1883, *R. Tate s.n.* (MEL 2065695); Encounter Bay District, Square Waterhole, in 1883, [*J.G.O.*] *Tepper 1076* (syn: MEL 2065694); Willunga to Pt. Victor [Victor Harbour], Square Waterhole, 4 November 1882 [*J.G.O.*] *Tepper 1076* [+*44*, January 1881] (syn: MEL 2065932).

***Notes*:** Mueller (1890) cited two localities when describing this species: near Encounter Bay and Kangaroo Island, with the names Professor Tate and O.Tepper. Four sheets of material collected by O.Tepper, all dated before the protologue, were found in MEL. A fifth sheet held at K (000950764) is apparently a duplicate of material at MEL (2065933). The sheet nominated here as lectotype agrees with Mueller's description and is annotated by Mueller with this name. The last syntype cited above (MEL 2065932) has a label which is difficult to interpret, but may indicate a mixed collection, or an attempt to cross-reference to other collections of this taxon made by Tepper.

3. Micrantheum ericoides Desf., *Mèm. Mus. Hist. Nat.* 4: 252–255, t.14 (1818). **Type:** [Australia] Port Jackson, [without date], *Baudin expedition 115* (lecto [here designated]: P 152756; isolecto: P 152757; P 152758).

Syntypes: 'Nov. Holl.', s.*dat.*, s.*coll.* (syn: G-DC G00313758 image seen); 'Nouvelle. Hollande' [received from P in 1824], *s.dat.*, *s.coll.* (syn: G-DC G00313759 image seen, G-DC G00313760 image seen).

***Notes*:** Desfontaines (1818) cited "Cet arbrisseau croit à la nouvelle Galle, où il a été observé et recueilli par les botanistes de l'expédition du capitaine Baudin. L'herbier du Muséum en possède plusieurs individus garnis de fleurs et de fruits." Three sheets of apparently original material collected during the Baudin expedition have been located at P [P 152756, P 152757, P 152758]. All the material agrees with the description in the protologue of *M. ericoides*. The sheet label [P 152756] is here selected as the lectotype of *M.*

ericoides. Three specimens at G-DC may well be duplicates of the lectotype, but the label data are insufficient to have any certainty.

4. Micrantheum hexandrum Hook.f., *London J. Bot.* 6: 283–284 (1847). **Type:** [Tasmania.] V. D. Land, Launceston, 27 September to 19 October 1839, *R.C. Gunn 35/1842* (lecto [here designated]: K 000950765, two largest branches at top of sheet (herb. Hook.), image seen; possible isolecto: CANB 333034 (ex BM) image seen, K 000950768 image seen, MEL 2065871).

Syntypes: [Tasmania.] V.D.L., in 1833, *R.W. Lawrance 292* (syn: K 000950767 image seen); Van Diemen's Isle, *s.dat.*, *J. Scott s.n.* (syn: K 000950766 image seen).

***Notes*:** In the protologue Hooker (1847) cited the locality "Launceston" with the names Scott, Lawrence and Gunn, suggesting collections made by them. There are two sheets at K which are stamped as originating from herb. Hookerianum that appear to be at least in part the material collected by Scott, Lawrence and Gunn and used by Hooker in the description of this species. The first sheet has three branchlets and two labels, while the second sheet has eight branchlets and two labels with several notes directly written on the sheet. The first sheet has two large branchlets with flowers attached which appear to be part of a single collection associated with Gunn's label '35/1842, Launceston, 27 Sept to 19 Oct 1839', while the other smaller branchlet with fruit is associated with the label '*Micrantheum hexandrum*, Gunn [illegible] 1832/35, v. Dland'. The larger two branchlets at the top of the sheet are selected as lectotype. As Gunn used species numbers rather than collecting numbers, it is impossible to determine if the isolectotypes are genuinely duplicates. In this case, it appears the species number '35' was allocated in 1842 to collections made in 1839, hence 35/1842.

Acknowledgement

Thanks to Russell Barrett for suggesting this solution to a long standing typification Gordian knot.

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A family's contribution to Queensland botany: John Howard Simmonds [Snr] (1862–1955), Rose Simmonds (*née Culpin*) (1877–1960) and John Howard Simmonds [Jnr] (1901–1992)

John Leslie Dowe

Summary

Dowe, John Leslie (2017). A family's contribution to Queensland botany: John Howard Simmonds [Snr] (1862–1955), Rose Simmonds (*née Culpin*) (1877–1960) and John Howard Simmons [Jnr] (1901–1992). ***Austrobaileya* 10(1): 168–183.** John Howard Simmonds Snr (1862–1955) was an amateur collector of botanical specimens, fossils and shells in south-east Queensland and northern New South Wales. About 2120 herbarium specimens can be attributed to J.H.Simmonds, although both his wife Rose Simmonds (*née Culpin*) (1877–1960) and their eldest son John Howard (Jack) Simmonds Jnr. (1901–1992) also collected botanical specimens under this designation. About 15 collections of botanical specimens by the Simmondses are designated as type materials, and about four fossil specimens collected by J.H. Simmonds Snr also represent type materials. Family members were eponymously commemorated in the names of 10 taxa of plants, liverworts, fungi and fossils.

Key Words: John Howard Simmonds, Rose Simmonds, John Howard (Jack) Simmonds, herbarium specimens, stonemason, fossil collector, Field Naturalists, Royal Society of Queensland, Queensland Naturalists' Club, plant pathology

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Introduction

This paper documents the contribution that three members of the Simmonds family made to Queensland botany and palaeontology. The father, John Howard Simmonds Snr [herein as JHS Snr] was an amateur naturalist with no scientific training, but he was active in botanical and fossil collecting 1882–1910. He earned a living as a stonemason and monument carver. A brief summary of his botanical collecting activities was provided by George (2009), but otherwise he did not receive a mention in Orchard (1999), the *Encyclopedia of Australian Science* (EOAS 2017), *Australian Plant Collectors and Illustrators* (CHAH 2017), or other biographical registers. This is in contrast to his wife Rose Simmonds (*née Culpin*) and their eldest son John Howard (Jack) Simmonds) (herein as JHS Jnr), both of whom have received considerable biographical attention (Rose for her innovative pictorial and art photography (Bradbury 2017; DAAO 2017), and JHS Jnr for his work as an internationally recognised plant pathologist (Alcorn & Purss 1992; EOAS 2015; Purss 2017). The younger son, Millice Alan Simmonds (1905–1983), appears to have had no interest in botanical or palaeontological activities.

There are some precautions to be taken when determining the botanical collections of JHS Snr. Both Rose Simmonds and JHS Jnr also collected botanical specimens, and it is not always possible to distinguish between them from labels and other collection data (see AVH 2017). JHS Jnr produced a number of important botanical publications (Veitch & Simmonds 1929; Simmonds 1938a, 1938b, 1966), and described a small number of new fungi during his career (Simmonds 1965, 1968). His standard author abbreviation is 'J.H.Simmonds' (IPNI 2017).

An unrelated collector, who also collected under the label name of J.H.Simmonds (AVH 2017; JGP 2017), was the New Zealand born Reverend Joseph Henry Simmonds (1845–

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1936). His standard author abbreviation is 'Simmonds' (IPNI 2017). Reverend Simmonds collected *Eucalyptus* specimens in New Zealand (cultivated) in 1918, and Tasmania and Victoria in 1921, mainly related to his interest in forestry research (Hall 1978). He was involved in the description of a number of taxa (Chippendale 1988), and *Eucalyptus simmondsii* Maiden [= *E. nitida* Hook.f.] was named for him (Maiden 1923).

Materials & methods

Herbarium and museum specimens

Searches for herbarium specimens appended with the collector name J.H.Simmonds and variations were conducted on the online catalogues of A, AVH, BISH, BM, G, GH, JStor Global Plants, K, L, NMNH, P and US. Staff at BRI, BRIP and MEL were consulted to gain access to their respective catalogue databases and/or libraries. For fossil specimens, the accessible databases of the collections of the Australia Museum, National Museum of Victoria and the Queensland Museum were examined and collections by JHS Snr were collated. For JHS Snr's stonemason and monument works, historical cemetery listings and heritage assessments were examined.

Archival materials

Conserved documents, related to the Simmonds family, were examined at the John Oxley Library, State Library of Queensland. Among the archives are a set of preliminary pencil drawings for monument and headstone carvings by JHS Snr, family photographs, financial records, land ownership records and a large collection of unframed and framed photographs by Rose Simmonds. The documents and items at John Oxley Library are listed in **Table 1**.

Table 1. Documents and items related to the Simmonds family in the John Oxley Library collection

John Howard Simmonds [Jnr] papers	M777, Boxes 6658O/S' 7686 O/S; 10402 O/S; 20169 O/S
Rose Simmonds photographs, 1920s–1940s	28932, Box 17335–17358
Rose Simmonds papers 1902–1941	27928, Box 16106
Rose Simmonds photographs: Louis Wilhelm, Karl Wirth & Hubert Jarvis	4570, Box 14316 O/S
Rose Simmonds, William Jolly Bridge 1931	29918
Fountain in the Brisbane Botanic Gardens *c.* 1885	30419, Box 5661

John Howard Simmonds and family

John Howard Simmonds [Snr] (**Fig. 1**) was born 15 July 1862 in Carlton, Victoria, and died 11 June 1955 in Brisbane. He earned a living as a stonemason and monument carver, operating under the business name of 'J.Simmonds' in Brisbane between 1880 and 1920 (see below for history of the business). He married English-born Rose Culpin (**Fig. 2**) (1877–1960) in 1900, and they had two sons, John Howard (Jack) Simmonds (herein as JHS Jnr) (1901–1992) and Millice Alan Simmonds (1905–1983). Rose was the daughter of Dr Millice Culpin (1846–1941). The Culpin family immigrated to Australia in 1891 and Dr Culpin established a general practice in Brisbane. He was socially and politically active and was elected as the Member of the Australian House of Representatives for Brisbane 1903–1906 (d'Eimar de Jabrun 2017).

Fig. 1. John Howard Simmonds [Snr] (1862–1955). Undated, photographer not known, John Oxley Library, State Library of Queensland: negative no. 82988.

Fig. 2. Rose Simmonds (*née* Culpin) (1877–1960). Circa 1905, photographer not known. John Oxley Library, State Library of Queensland: negative no. 82987.

Rose was active in photography from about 1927 through to 1940. She experimented with pictorialist and creative photography and was involved in many public exhibitions. Her work was described as 'painterly' and reminiscent of the Impressionist movement (Hall & Mather 1986; Bradbury 2017; DAAO 2017). About 200 of her photos are now held in the Queensland Art Gallery, the John Oxley Library and the National Gallery of Victoria. JHS Jnr was an internationally recognised plant pathologist, completing his MSc at the University of Queensland. He was awarded an MBE for his work on malaria infection control in Papua New Guinea during WW II. After the war, he was promoted to head of the Department of Entomology and Pathology within the Queensland Department of Agriculture (Alcorn & Purss 1992). As noted above, these three members of the family were active in botanical collection, albeit with different foci and at different times, although there was some overlap which requires that some caution be taken when allocating the collector's identity. There is no indication that the younger son Millice Alan shared the same interests as his father, mother and brother.

'J.Simmonds': stonemason

JHS Snr represented the third generation of a family of stonemasons. His grandfather, John Simmonds Snr (1793/94–1860) was a builder and stonemason in Dorsetshire, England. He immigrated with his wife and eight children to Australia in November 1852 on the *Lady Eveline* and set up business in Melbourne (Sellers 2005). Apart from being a stonemason, he was the Deputy Registrar of

Births and Deaths for the Brighton District, Victoria (VRGO 1856). After his death in 1860,[1] the stonemason business was taken over by his eldest son John Simmonds Jnr (1828–1889) (JHS Snr's father) who, from 1857, carried on the business in Melbourne and traded under the name of 'J.Simmonds' from about 1868 onward (Sellers 2005). In an effort to improve his circumstances, JS Jnr moved with his wife and nine children to Brisbane in 1880, first operating from premises in Adelaide Street. JHS Snr, then at the age of 18 years, was apprenticed to his father at that time. Upon the death of JS Jnr in 1889, JHS Snr (at 27 years old) took over the business and continued to operate the company under its original name and in 1897 moved to Ann Street adjacent to St Andrew's Church. The business ceased operating with the retirement of JHS Snr in 1920 at the age of 58.

Works by 'J.Simmonds' are to be found in many cemeteries throughout Queensland, and less so in public and church memorials and plaques (these are to be distinguished from the works by 'J.Simmonds' in Victoria which were produced by JHS Snr's father and grandfather). A characteristic feature of many of JHS Snr's work is the carvings of garlands of flowers, a somewhat signature style that set him apart from other stonemasons then working in Brisbane. The garlands usually included traditional symbolic gravestone flowers such as morning glory, roses, dogwood, *Hibiscus* and poppy, and leaves such as ivy, acanthus, olive and tobacco (**Fig. 3**). Gravestones carved by J.Simmonds are to be found in cemeteries in Cairns, Charters Towers, Clermont, Cooktown, Croydon, Mackay, Maryborough, Nundah, Redland

Fig. 3. An example of John Howard Simmonds Snr's stonemason work. Carved garland of flowers on the monument of Thomas Joseph Byrnes, Toowong Cemetery. Photo: J.L. Dowe, March 2017.

[1] Argus, 13 March 1860, p. 4, 'Deaths'

Bay, South Brisbane, Thursday Island and Toowong. There are possibly others that are yet to be located and documented.

JHS Snr worked mostly with marble and occasionally with sandstone. One of the surviving public memorials produced by J.Simmonds is a marble wall-plaque commemorating Father James Horan (1846–1905) in St Mary's Church Warwick (*pers. obs.*). A number of his larger public works are known to have been destroyed, including an ornamental fountain that was installed in 1882 in the Brisbane Botanic Gardens (Pink 1883). This was removed during redevelopment of the Gardens in 1958 (Dowe 2017). The company also erected a public water fountain in 1888 in Ann Street outside of the Temperance Hall commemorating the Women's Christian Temperance Union[2], but there is no record of the time or reason for its removal. J.Simmonds also provided two elaborate memorial plaques to the Reverend Robert Harley (1864–1892)[3]. These were installed in now demolished churches in Rockhampton and the fate of the plaques is not known. Some of J.Simmonds' cemetery works have been deemed of historical interest and are included in the Queensland Heritage Register as listed in **Table 2**.

Table 2. The cemeteries in which works of 'J.Simmonds' are included in the Queensland Heritage Register (https://www.qld.gov.au/environment/land/heritage/register)

Cooktown Cemetery	QHR: 601147
Mackay Cemetery	QHR: 602766
Clermont Cemetery	QHR: 602756
Maryborough Cemetery	QHR: 600689
Redland Bay: Serpentine Creek Road Cemetery	QHR: 601927

Scientific interests

It appears that JHS Snr first took an interest in geology and botany in the early 1880s when he began to collect fossil specimens in the Ipswich area and established a personal collection. He also began to make donations to the Queensland Museum at that time[4]. He was a founding member of the *Royal Society of Queensland* [RSQ] which was established in 1884 (Anon. 1885). This and his subsequent association with the RSQ placed him in contact with scientists such as Frederick Manson Bailey (botanist), John Frederick Bailey (botanist), Thomas Lane Bancroft (naturalist), Lewis Adolphus Bernays (economic botanist), Charles Walter de Vis (zoologist), Robert Logan Jack (geologist), Joseph Lauterer (botanist), John Shirley (lichenologist and botanist) and Henry Tryon (entomologist) amongst others. This was a significant time in the history of taxonomic research of the Queensland flora, as regional institutions had become sufficiently developed to allow such work to be undertaken by local scientists, rather than by botanists in the southern colonies (such as Ferdinand Mueller in Melbourne, and Charles Moore and Joseph Maiden in Sydney), and whose influence had waned as colonial Queensland became increasingly independent (Marks 1960).

The Field Naturalists' section within the RSQ was established in October 1886 to facilitate 'the furtherance of original research' (Anon. 1886). JHS Snr was appointed as a

[2] Telegraph, 8 February 1888, p. 5, 'A drinking fountain'

[3] Morning Bulletin (Rockhampton), 16 August 1892, p. 4.

[4] The Week, 9 September 1882, p. 14, 'Queensland Museum'

Committee Member at the first meeting of the section (Bailey 1887). Initially, the Field Naturalists' section was very active, and by July 1887 had completed 19 field excursions mostly as half or full day-trips within the Brisbane region (Bailey 1887). By 1891, the excursions had become increasingly irregular and by 1894 had all but ended apart from an occasional excursion that focused exclusively on the collection of botanical specimens (Bailey & Ryott-Maughan 1891; Shirley & Ryott-Maughan 1893).

JHS Snr's greatest productivity as a botanical collector was during his association with the RSQ. However, many specimens collected during the excursions were simply labelled as the 'Field Naturalists' without reference to individuals, and such specimens cannot be included unquestionably among JHS Snr's collections.

JHS Snr remembered with affection and delight his fellow members of the RSQ and published an eight-page poem titled '*Some odd memories of the Field Naturalist's Club*' (Simmonds 1893). It started with:

> *As I sat by the fireside, my book on my knee,*
>
> *My memory foregathered that old company,*
>
> *I had tramped with so often thro' forest and scrub,*
>
> *Those friends of old time in the Bug-hunter's Club.*

In the poem, Simmonds went on to entertainingly describe the personalities and idiosyncrasies of many of the members of the Field Naturalists' section. For example, he wrote that John Shirley was prone to getting lost: '*If you followed his leading you found a 'mare's nest'*', and he described F.M.Bailey as '*Our kindly Professor, and Leader and Friend*', and whose '*kindness and patience were always unfailing*'.

To honour his status as a founding member and long-term active service to the RSQ, JHS Snr was elected as an Honorary Life Member in 1934 (Perkins 1935; Marks 1960). During his time with the RSQ, JHS Snr developed a particularly close and lasting friendship with F.M. Bailey (Simmonds 1991), and made an annual pilgrimage to Bailey's grave at South Brisbane Cemetery for many years after his passing in 1915 (White 1945, 1950). JHS Snr's membership of the RSQ lapsed between 1903 and 1923, but he re-joined in 1924 (along with JHS Jnr), and remained in continuous membership until his death in 1955. At the passing of JHS Snr in 1955, he was remembered as the last surviving foundation member of the RSQ and for his generosity in donating specimens, particularly his 'outstanding collection' of fossil plants and insects (Anon. 1955), and botanical specimens, to various institutions.

The Queensland Naturalist's Club

In apparent response to the lack of activity of the RSQ's Field Naturalists' section, the *Queensland Naturalists' Club* [QNC] was inaugurated in 1907. JHS Snr was an early member and during 1909–1910 collected a significant number of botanical specimens, many of which he appears to have maintained in his private herbarium. Initially, he was not an office bearer and it was only when JHS Jnr became a committee member in 1925 that he, JHS Snr, became more active within the QNC (Anon. 1925), and acted as Honorary Librarian 1929–1930 (Whitehouse & Baird 1930; Holland & Marks 1956). JHS Jnr was elected as Vice-President of the QNC in 1941 (Anon. 1941), although his tenure was interrupted by active service in WW II (Blake & Baird 1942). On his return in 1945, he was again elected as Vice-President 1946–1947 (Anon. 1946; Anon. 1947) and then President 1948–1949 (Anon. 1948; Anon. 1949). JHS Jnr appears to have become inactive in the Club after about 1951.

Botanical collections

Based on a search of 'J.H. Simmonds' in the primary databases of AVH, HerbRecs, JStor Global Plants, Kew Herbarium and MELISR, about 2130 herbarium specimens were located and collated into a working master-list. Those records that did not relate to JHS Snr and his family were removed from the list and a final list consisted of 2124 entries. Of these the greatest number are at BRI (1882), and with less but otherwise significant numbers in

NSW (114). AD (72) and MEL (26). Between one and 10 specimens were located at each of the following herbaria: BISH, BM, BRIP, CANB, CBG, CNS, G, K, L, MICH, NMNH and PERTH. Searches of the databases of some herbaria that could potentially hold J.H. Simmonds' specimens, such as A, GH, P and US, yielded no current records. Of the total number of specimens, about 1300 taxa are represented. It is possible that other specimen records may not have been located during the database searches, but it is assumed that the majority of the specimens collected by the Simmondses has been located. The personal collection of JHS Snr as presented by J.H. Simmonds Jnr was donated to the Queensland Herbarium in August 1960.

Of the 2124 specimens, about 1871 have collection dates (with 253 undated). Of the dated specimens, some 1745 specimens were collected during two periods of activity. The first covered 1886–1896 when about 1533 specimens were collected and then 1907–1916 when a further 212 specimens were collected. These two periods account for about 93% of the dated specimens.

In addition to the searches for J.H. Simmonds' collections, a search was made for specimens labelled as the 'Field Naturalists', relating to the RSQ, and dated between 1884 and 1895 (JHS Snr's most active years). Unless JHS Snr was clearly listed as one of the collectors, specimens labelled as collected by the Field Naturalists were excluded from the master list. Many of the RSQ field excursions involved JHS Snr, and he wrote a number of reports about the activities and collections (Simmonds 1888a, 1888b, 1889a–e; Simmonds & Grimes 1889). At the RSQ meetings, JHS Snr regularly presented exhibits of the plants that were collected during the excursions, both as fresh specimens and pressed herbarium specimens (Anon. 1888a–c; Saville-Kent & Ryott-Maughan 1891).

Searches of the taxonomic literature indicate that many specimens collected by JHS Snr have been cited both as voucher specimens and as type materials. For example, ten JHS Snr specimens were cited in the *Queensland Flora* by Bailey (1899–1902). With regard to type citations, a total of 15 have been identified and are included in **Table 3**. As for eponyms related to the Simmondses, ten names have been identified and these are also included in **Table 3** (NB. The fossils named for JHS Snr are included in a following section and table).

A summary of the specimens labelled as 'J.H. Simmonds' and known to relate to the family of John Howard Simmonds, indicates that about 10 specimens were recorded as jointly collected by Bailey (either F.M. or J.F.) & Simmonds; at least 60 can be assigned to JHS Jnr, and of which most are flowering plants but there are a significant number of fungi; and about four to Rose Simmonds, all of which are flowering plants. The plant groups collected by JHS Snr included herbs (most commonly collected families included Asteraceae, Euphorbiaceae, Lamiaceae, Orchidaceae), shrubs (Fabaceae, Malvaceae, Rubiaceae), grasses (Poaceae), sedges (Cyperaceae), ferns (Pteridaceae, Hymenophyllaceae, Linsaeaceae), and trees (Lauraceae, Myrtaceae, Proteaceae, Sapindaceae).

To my knowledge, there is only a single novel name introduced by JHS Snr (Simmonds 1889b): *Croton phebalioides* var. *hispida* J.Simmonds [= *Croton phebalioides* F.Muell. ex Müll.Arg.] (**Table 3**) was included in a list of plants collected at Moggill Creek, December 1888. However, the name is invalid and a *nomen nudum* and Forster (2003) noted that 'There is no diagnosis or type for this name'.

Fossil collections

Reconciling the status and nomenclature of the fossils collected by JHS Snr was beyond the scope of this paper. However, some general comments on his collections can be made. JHS Snr made collections mainly of fossil plants and secondarily of insects, mostly from Denmark Hill near Ipswich. His first collections are dated as 1882 and his last as 1890. There are no known animal fossils collected by him.

Table 3. Taxa of plants, ferns, liverworts and fungi associated with the Simmonds family, with regard to new names, typification and eponyms

The recipient of the eponymous recognition is indicated. Details of the type citation, type specimens and typification proposals are included.

Aspidium eumundi F.M.Bailey, *Bot. Bull. Dept. Agric. Queensland* 5: 27 (1892). [= *Arthropteris beckleri* (Hook.) Mett.] (Dryopteridaceae)	**Type citation:** Condamine, *C.H. Hartmann*; Tallebudgera, *J.F. Shirley*; Eumundi *J.F. Bailey*, and *J.H. Simmonds*. **Type:** Queensland. Moreton District: Eumundi, May 1892, *J.F. Bailey & J.H. Simmonds s.n.* (lecto: BRI [AQ170505 (*p.p.* sheet 258320]); isolecto: MEL 239379, *fide* Bell, *Fl. Australia* 48: 712 (1998)).
Baeckea virgata var. *parvula* F.M.Bailey, *Queensland Fl.* 2: 585 (1900), *nom. inval.*, *nom. nud.* [= *Sannantha bidwillii* (A.R.Bean) Peter G.Wilson] (Myrtaceae)	**Type citation:** Eumundi, *Bailey* and *Simmonds*. **Type:** not designated, *fide* Bean, ***Austrobaileya*** 5: 161 (1999).
Bipolaris simmondsii Y.P.Tan & R.G.Shivas, *Mycol. Progr.* 15: 1210 (2016). (Pleosporaceae) [Named for JHS Jnr]	**Type:** Queensland. Moreton District: Peregian Beach, on leaf spot on *Zoysia macrantha* Desv., 14 November 1976, *J.L. Alcorn s.n.* (holo: BRIP 12030, *fide* Tan *et al.*, *Mycol Progr.* 15: 1213–1214 (2016)). ***Etymology*:** Named after the Australian plant pathologist Dr. John Howard (Jack) Simmonds MBE, who listed the first helminthosporioid fungi found in Queensland.
Bursera australasica F.M.Bailey, *Bot. Bull. Dept. Agric. Queensland* 5: 8 (1892); *Protium australasicum* (F.M.Bailey) Sprague, *Bull. Misc. Inform. Kew 1912* (8): 370 (1912). [= *Canarium australasicum* (F.M.Bailey) Leenh.] (Burseraceae)	**Type citation:** Eumundi, *J.F. Bailey* and *J.H. Simmonds*. **Type:** Queensland. Wide Bay District: Eumundi, May 1892, *J.F. Bailey & J.H. Simmonds s.n.* (holo: BRI [AQ333204]; iso: BM 000798993, *fide* Hewson, *Fl. Australia* 25: 169 (1985)).
Colletogloeum simmondsii B.Sutton & H.J.Swart, *Trans. Brit. Mycol. Soc.* 87: 97 (1986). (Mycosphaerellaceae) [Named for JHS Jnr]	**Type:** Queensland. Leichhardt District: In phyllodis vivis Acaciae complanatae, Isla Gorge, August 1973, *J.H. Simmonds s.n.* (holo: BRIP 8881; iso: IMI 287732), *fide* Sutton & Swart, *Trans. Br. Mycol. Soc.* 87: 97 (1986). ***Etymology*:** "Dr J.H. Simmonds, plant pathologist, Queensland".
Colletotrichum acutatum J.H.Simmonds, *Queensl. J. Agr. Anim. Sci.* 25: 178A (1968). (Glomerellaceae)	**Type:** Queensland. Moreton District: isolated from *Carica papaya*, Ormiston, [*J.H. Simmonds s.n.*], 1 October 1965 (holo: IMI 117617).

Colletotrichum gloeosporioides var. *minus* (as *minor*) J.H.Simmonds, *Queensl. J. Agr. Anim. Sci.* 25: 178A (1968). [= *Colletotrichum queenslandicum* B.S.Weir & P.R.Johnst.] (Glomerellaceae)	**Type:** Queensland. Moreton District: isolated from *Carica papaya*, Ormiston, 1 October 1965, [*J.H. Simmonds s.n.*] (holo: IMI 117612).
Colletotrichum simmondsii R.G.Shivas & Y.P.Tan, *Fungal Divers.* 39: 119 (2009). (Glomerellaceae) [Named for JHS Jnr]	**Type:** Queensland. Moreton District: Yandina, on *Carica papaya*, May 1987, *L.M. Coates s.n.* (holo: BRIP 28519). ***Etymology*:** "named after John (Jack) H. Simmonds (1901–1992), an eminent Australian plant pathologist who first named *Colletotrichum acutatum*".
Croton phebalioides var. *hispida* J.Simmonds, *nom. inval., nom. nud.*, *Proc. Roy. Soc. Queensland* 6: 68 (1889) [= *Croton phebalioides* F.Muell. ex Müll. Arg.] (Euphorbiaceae)	**Type citation:** Hairy cascarilla; in flower. **Type:** not designated, *fide* Forster, *Austrobaileya* 6(3): 428 (2003) ['There is no diagnosis or type for this name'].
Eugenia punctulata F.M.Bailey, *Bot. Bull. Dept. Agric. Queensland* 13: 10 (1896). [= *Syzygium coryanthum* (F.Muell.) L.A.S.Johnson] (Myrtaceae)	**Type citation:** Eumundi, *R.D. Power*, 1894; *J.H. Simmonds*, in flower June, 1895. **Type:** Queensland. Wide Bay District: Eumundi, June 1895, *J.H. Simmonds s.n.* (syn: BRI [AQ275979], MEL 60212), *fide* Hyland, *Aust. J. Bot.* Suppl. 9: 72 (1983).
Eugenia simmondsiae F.M.Bailey, *Queensland Agric. J.* 23(6): 297 (1909). [= *Syzygium australe* (H.L.Wendl. ex Link) B.Hyland] (Myrtaceae) [Named for Rose Simmonds]	**Type citation:** Tambourine Mountain, *Mrs. J.H. Simmonds.* **Type:** Queensland. Moreton District: Tambourine Mountain, October 1909, *Mrs J.H. Simmonds s.n.* (holo: BRI [AQ291645]; iso: MEL 67176), *fide* Hyland, *Aust. J. Bot.* Suppl. 9: 55 (1983).
Ficus simmondsii F.M.Bailey, *Queensland Agric. J.* 25(5): 234 (1910). [= *Ficus watkinsiana* F.M.Bailey] (Moraceae) [Named for JHS Snr]	**Type citation:** Coolangatta, *J.H. Simmonds.* **Type:** New South Wales. Tweed Heads, October 1910, *J.H. Simmonds s.n.* (holo: BRI [AQ23338]), *fide* Chew, *Fl. Australia* 3: 40 (1989).
Frullania simmondsii Steph., *J. & Proc. Roy. Soc. New South Wales* 48: 109 (1914) (Frullaniaceae) [Named for JHS Snr]	**Type citation:** Hab. Australia, (near Brisbane): *Simmonds leg.* (Watts, 1110). **Type:** Queensland. Moreton District: Brisbane, August 1887, *J.H. Simmonds s.n.* (syn: BRI [AQ722450]; G 00069106, MEL 0061851).

Helicia youngiana var. *robusta* C.T.White, *Contrib. Arn. Arbor.* 4: 23 (1933). [= *Triunia robusta* (C.T.White) Foreman] (Proteaceae)	**Type citation:** Maroochy (most southerly record), *F.M. Bailey*, *J. Low*. Yandina Eumundi, *J.F. Bailey*, *J.H. Simmonds*, *J.B. Staer*. East Malanda, Atherton Tableland, alt. 700 m., common in rain-forest, *S.J. Kajewski, no. 12119* (flower buds), Sept. 22. **Type:** Queensland. Wide Bay District: Eumundi, November 1892, *J.H. Simmonds s.n.* (lecto: BRI [AQ317462]; isolecto: BRI [AQ317468]), *fide* Foreman, *Muelleria* 6: 196 (1986)).
Liparis simmondsii F.M.Bailey, *Bot. Bull. Dept. Agric. Queensland* 3: 18 (1891). [= *Diteilis simmondsii* (F.M.Bailey) M.A.Clem. & D.L.Jones] (Orchidaceae) [Named for JHS Snr, Bailey F.M. *Queensland Fl.* 5: 1521 (1902)]	**Type citation:** Hab.: On sandy land bordering swamps, Eudlo Creek, *Field Naturalists*, March, 1891. **Type:** Queensland. Moreton District: Eudlo, *Field Naturalists s.n.*, March 1891 (holo: BRI [AQ279626]).
Nephelium lautererianum F.M.Bailey, *Bot. Bull. Dept. Agric. Queensland* 4: 8 (1899). [= *Mischarytera lautereriana* (F.M.Bailey) H.Turner] (Sapindaceae)	**Type citation:** Hab.: Eudlo scrubs, *Field Naturalists*, Nov. 1891 (flowering specimens *J.H. Simmonds and J.F. Bailey*, May 1896). **Type:** Queensland. Moreton District: Eudlo, 1891, *Field Naturalists, J.H. Simmonds & F.M. Bailey s.n.* (holo: BRI [AQ22532]; iso: BM 000884192), *fide* Reynolds, *Fl. Australia* 25: 89 (1985).
Potamogeton perfoliatus var. *minor* F.M.Bailey, *Compr. Cat. Queensland Pl.* 583 (1913). [= *Potamogeton perfoliatus* L.] (Potamogetonaceae)	**Type citation:** Tambourine Mountain (*J.H. Simmonds*). **Type:** Queensland. Moreton District: Tambourine Mt, October 1909, *J.H. Simmonds s.n.* (holo: BRI [AQ102546]).
Psychotria simmondsiana F.M.Bailey var. *simmondsiana*, *Bot. Bull. Dept. Agric. Queensland* 2:13 (1891). (Rubiaceae) [Named for JHS Snr, Bailey, *Queensland Fl.* 3: 772 (1900)]	**Type citation:** Hab.: Tambourine Mountain and Mooloolah scrubs, *Field Naturalists*. **Type:** Queensland. Moreton District: Mooloolah, December 1890, *Field Naturalists & J.H. Simmonds s.n.* (syn: BRI [AQ318252, AQ125353, AQ125354]).
Quasidiscus simmondsii B. Sutton, *Sydowia* 43: 278 (1991) (Ascomycota) [Named for JHS Jnr]	**Type:** *In foliis emortuis Macadamiae*. Australia, J.H. Simmonds Plot, Queensland, Brookfield, 28 August 1981, *B.C. Sutton & J.L. Alcorn s.n.* (holo: IMI 263340c), *fide* Sutton, *Sydowia* 43: 264–280 (1991). ***Etymology*:** "after the late J.H. Simmonds, noted Queensland plant pathologist".

Septobasidium simmondsii Couch ex L.D. Gómez & Henk, *Lankesteriana* 4: 92 (2004); *Septobasidium simmondsii* Couch, *The genus Septobasidium* 279 (1938), *nom. inval.* (Septobasidaceae) [Named for JHS Jnr]	**Type:** Queensland. Moreton District: Yarraman, on *Milletia megasperma*, 9 January 1934, *ex Herb. Plant Pathology Brisbane no. 3431* (holo: NCU).
Xerotes confertifolia F.M.Bailey, *Queensland Agric. J.* 25: 11 (1910) [= *Lomandra confertifolia* (F.M.Bailey) Fahn] (Asparagaceae)	**Type citation:** Glasshouse Mountains, Bail.; Mount Cooroy, Bail. and Simmonds; Mount Perry, Jas. Keys. **Type:** Queensland. Moreton District: Glasshouse Mts, summit of Mt Cooroy, November 1892, *F.M. Bailey s.n.* (lecto: BRI [AQ24464]), *fide* Lee, *Contr. New South Wales Natl. Herb.* 3: 156 (1962).
Zieria furfuracea subsp. *gymnocarpa* J.A.Armstr., *Austral. Syst. Bot.* 15(3): 363 (2002). (Rutaceae)	**Type citation:** Belmont, J.H.Simmonds 10.ix.1987; holo: BRI 111809. **Type:** Queensland. Moreton District: Belmont, 10 September 1887, *J.H. Simmonds s.n.* (holo: BRI [AQ318534]), *fide* George *et al.*, *Fl. Australia* 26: 309 (2013).

His collections were variously described as 'important', 'beautiful' and 'magnificent' by the palaeontologists who examined them. The fossil taxa named to commemorate JHS Snr are presented in **Table 4**.

JHS Snr's fossil collection appears to have been mostly housed at his residence at Taringa. Some specimens were donated to the Queensland Museum, but it most likely that JHS Snr retained most of the specimens as a private collection. The collection was subsequently donated to the Department of Geology at the University of Queensland sometime prior to 1947 and then transferred to the Queensland Museum during the 1990s (Greg Webb, *pers. comm.*). A few specimens collected by him have been located in the collections of Australia Museum and Museum Victoria.

Shell collections

Little is known about JHS Snr's shell collection. The first recorded mention of his collection was in 1927 (Anon. 1927) and then with regular reports through to about 1937 (Anon. 1937). The history and fate of the collection is not known, although the Queensland Museum holds a small number that were collected and donated by him.

Summary

The contributions of amateur botanists and scientists have been integral to the development of taxonomic research in Australia (Barker & Barker 1990; Clarke 2008; Maroske 2014; Dowe 2015, 2016; Bean 2016). John Howard Simmonds Snr can be included in the group of amateurs who have provided seemingly small contributions, but when such contributions are taken together they add up to an important consolidation toward taxonomic progress.

At the time that JHS Snr was actively collecting, Queensland botany was presided over by the Colonial Botanist F.M. Bailey, which culminated in the publication of his *Queensland Flora* (Bailey 1899–1902). This work summarised the older taxonomy and integrated both the taxa recently introduced by Bailey in previous publications, and new taxa first described in the *Flora*. At least 10 specimens collected by JHS Snr are cited in the *Flora*.

Table 4. Fossil taxa commemorating John Howard Simmonds Snr.

Taxa	Etymology
Araucarioxylon simmondsii Shirley, *Queensl. Geo. Survey. Bull.* 7: 14 (1898) (fossil plant)	Not given.
Ginkgo simmondsii Shirley, *Queensl. Geo. Survey. Bull.* 7: 12, pl. 1 (1898) [*Baiera simmondsii* (Shirley) Seward; *Ginkgoites simmondsii* (Shirley) Florin] (Jones & Jersey 1947) (fossil plant, Denmark Hill):	"This plant has been named after Mr. J.H. Simmonds, the collector, and former Secretary of the Brisbane Field Naturalists' Society".
Simmondsia Dunstan, *Queensl. Geol. Survey,* Publication No. 273, Part 1: 35. 1923. (Fossil beetle genus, Denmark Hill)	"The genus is named after Mr. J.H. Simmonds, whose explorations many years ago at Denmark Hill resulted in the finding of the first fossil insects in that locality".
Simmondsia subpyriformis Dunstan, *Queensl. Geol. Survey*, Publication No. 273, Part 1: 36. 1923. (Fossil beetle, Denmark Hill).	
Simmondsia cylindrica Dunstan, *Queensl. Geol. Survey*, Publication No. 273, Part 1: 37. 1923. (Fossil beetle, Denmark Hill).	
Simmondsia permiana Ponomarenko, *Paleontol. J.* 47: 713. (2013). [= *Proterocupes permiana* Ponomarenko]. (Fossil beetle, Vologda Region, Russia).	
Simmondsia ragosini Rohdendorf, *Tr. Paleontol. Inst. Akad.*85: 393. (Fossil beetle, Kutsnetsk Basin, Russia).	
Stachyopitys simmondsii Shirley, *Queensl. Geo. Survey. Bull.* 7: 13, pl. 18, fig. 2 (1898) [= *Umkomasia simmondsii* Shirley 1898 (*Pteruchus simmondsii* Shirley 1898. (Fossil plant, Denmark Hill)	"Mr. J. Simmonds".

With regard to botany, JHS Snr's contribution consisted of botanical collecting and documenting field excursion activities that were mostly published in reports in the *Proceedings of the Royal Society of Queensland* (Simmonds 1888a,b, 1889a–e; Simmonds & Grimes 1889; Bailey 1892, 1895). His contributions to palaeontology included the accumulation of a large collection of plant and insect fossils that was later studied by palaeontologists then working in Queensland (Etheridge & Olliff 1890; Jack & Etheridge 1892; Lauterer 1897; Shirley 1898, 1901; Dunstan 1900, 1923; Tillyard & Dunstan 1916; Tillyard 1917, 1919; Walkom 1917; Jones & Jersey 1947; Dodds 1949). He is commemorated in the plants *Ficus simmondsii* F.M.Bailey [= *Ficus watkinsiana*

F.M.Bailey], *Liparis simmondsii* F.M.Bailey [= *Diteilis simmondsii* (F.M.Bailey) M.A.Clem. & D.L.Jones] and *Psychotria simmondsiana* F.M.Bailey; the liverwort *Frullania simmondsii* Steph.; the fossil plants *Araucarioxylon simmondsii* Shirley, *Ginkgo simmondsii* Shirley [= *Ginkgoites simmondsii* (Shirley) Florin], and *Stachyopitys simmondsii* Shirley [= *Umkomasia simmondsii Shirley*]; and the fossil beetle genus *Simmondsia* Dunstan.

The contribution of Rose Simmonds was mainly as support to her husband. A number of specimens were collected by her and accordingly, as was the social convention of the era, recorded as 'Mrs J.H. Simmonds'. However, her most significant social contribution was to the development of art photography in Australia (Bradbury 2017). She is commemorated in *Eugenia simmondsiae* F.M.Bailey [= *Syzygium australe* (H.L.Wendl. ex Link) B.Hyland].

The work of JHS Jnr was primarily in the field of plant pathology for which he was internationally recognised as an expert in tropical fruit diseases and associated mycology. He was awarded an MBE for his work on malaria infection control during WWII and in his latter career, 1946–1966, headed the Department of Entomology and Pathology within the Queensland Department of Agriculture (Alcorn & Purss 1992). He is commemorated in the fungi *Bipolaris simmondsii* Y.P.Tan & R.G.Shivas, *Colletogloeum simmondsii* B.Sutton & H.J.Swart, *Colletotrichum simmondsii* R.G.Shivas & Y.P.Tan, *Quasidiscus simmondsii* B.Sutton and *Septobasidium simmondsii* Couch ex L.D. Gómez & Henk.

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Atriplex alces Edginton & E.J.Thomps. (Chenopodiaceae), a new species from central Queensland, Australia

Summary

Edginton, M. & Thompson, E.J. (2017). *Atriplex alces* (Chenopodiaceae), a new species from central Queensland, Australia. ***Austrobaileya* 10(1): 184–195.** A new species of *Atriplex* L. (*Atriplex alces* Edginton & E.J.Thomps.) endemic to central Queensland is described and illustrated. Its affinity to *Atriplex eardleyae* Aellen is discussed and a table of differences is presented.

Key Words: Chenopodiaceae, *Atriplex*, *Atriplex alces*, *Atriplex eardleyae*, Australia flora, Queensland flora, Edgbaston

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Introduction

Atriplex L. is a cosmopolitan genus of over 250 species occurring predominantly in subtropical and temperate regions on saline soils (Wilson 1984). Approximately 66 described species occur in Australia (Australian Plant Census 2017). Wilson (1984) described 60 species for Australia of which two are introduced, and with 15 native species occurring in Queensland. Bostock & Holland (2016) recorded 32 native species for Queensland. All of the Australian native species are endemic except for one which also occurs in New Zealand (Wilson 1984). Australian Plant Census 2017 listed a further four species of *Atriplex* as naturalised in Australia.

The new species described in this paper was brought to the attention of botanists at the Queensland Herbarium (BRI) from material collected at Edgbaston Reserve by Bush Heritage ecologist Paul Foreman. Edgbaston Reserve is a Bush Heritage property in central Queensland overlapping the Pelican Creek artesian spring complex that is well known for its extraordinary fauna and flora. The property is known to contain 11 threatened plant species, including *Atriplex morrisii* R.H.Anderson., a **Vulnerable** species (under *Nature Conservation Act 1992*).

The new species has similarities to *Atriplex eardleyae* Aellen, from which it is distinguished in this paper.

Material and methods

This study was based upon the examination of dried herbarium material and label data held at BRI, and field observations. Digital images of the type specimen of *Atriplex eardleyae* (JSTOR 2016) were examined.

Drawings were undertaken using rehydrated Herbarium specimens.

Leaf transverse sections were prepared free-hand by a modified version of the method described by Frohlich (1984), using fresh material for the new species and dried herbarium material for *A. eardleyae*. Herbarium material was rehydrated by initial immersion in hot water and left to soak for several hours. Instead of sandwiching the leaf material between pieces of paraffin as used by Frohlich (1984), each sample was placed on a glass slide covered with a glass slide cover which was used as a cutting guide. Thin sections were created while viewing at ×4 magnification under a binocular microscope.

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Photographs, other than for the type, were taken using a Nikon DS – Fil microscope camera coupled with a Leica MZ6 stereomicroscope. Composite images were produced by combining single images using Helicon focus version 5.2 (Helicon Soft 2016). This improved depth of field.

In common with many other species of *Atriplex*, the bracteoles of *A. alces* are enlarged and cover the fruit. This means that the structure on most *Atriplex* which presents ostensibly as the 'fruit', and is commonly referred to as such, is actually the fruit with bracteoles. For the purposes of this study, the term 'fruit' is used for the structure which presents ostensibly as the fruit.

Taxonomy

Atriplex alces Edginton & E.J.Thomps. **sp. nov.** Similar to *A. eardleyae* Aellen differing by the narrower leaves, seed and the intricately divided fruiting bracteoles with larger appendages. **Typus:** Queensland. Mitchell District: On Edgbaston Station, 33 km NNE of Aramac, 8 April 2010, *E.J. Thompson MUT401 & M. Edginton* (holo: BRI).

Decumbent to ascending perennial forb to subshrub up to 0.5 metres with a tap root, monoecious; foliage scurfy, with bladder scales (i.e. minutely vesicular). Leaves narrowly oblanceolate to linear, 5–15 mm long, 0.8–3 mm wide, grey; bladder scales in multiple layers, hence venation not visible through the scurf; base attenuate to narrowly cuneate into a short petiole, or sessile to subsessile, apex obtuse to sub-acute. Male flowers in small glomerules or short spikes of 7–30 flowers, or sometimes short racemes of 2–5 small glomerules each with 4–8 flowers, in upper leaf axils, usually with a few female flowers. Female flowers otherwise single or in small glomerules of 2–7 flowers, in medial to sub-distal leaf axils. Fruits 5–7 mm long. Fruiting bracteoles laterally fused from base to beyond the midpoint of their length; ovary tube often thinly scurfy, reticulate (not always obvious due to scurf), compressed, ± rectangular, rarely obtriangular, narrowing slightly to broad-cuneate into stipe, ovary tube 1.5–2.3 mm long, *c.*1 mm wide, expanding into valves at tip. Valves 1–1.6 mm long, 4–8 mm wide at top; fan-shaped to reinform at top, reticulate (not always obvious due to scurf), with broadly deltoid primary lobes, which are again divided into fine subulate to very narrowly deltoid secondary lobes, which are aligned with primary lobes or spreading, lending the bracteole a moose antler-like appearance. Tube with a pair of sessile (i.e. with linear-oblong attachments in line with the axis of the fruit) dorsal appendages usually similar in shape and texture, and sometimes size, to the concomitant side (i.e. left hand side or right hand side) of the valve, or appendages lacking. Stipe slender or stout, much shorter than tube to more than 3 times the length of tube. Seed oblong-elliptic, laterally compressed, *c.* 2 mm long × 1.2 mm wide × 0.5 mm thick; margins thickened, projecting into an ascending radicle on one side; pale brown in dried specimens. **Figs. 1–4, 6, 7, 10, 12, 14.**

***Additional specimens examined*: Queensland.** Mitchell District: 93 km E of Muttaburra on stock route through Sumana Station, Apr 2011, *Thompson MUT481 & Edginton* (BRI); 94 km East of Muttaburra on stock route through Sumana Station, Apr 2011, *Thompson MUT483 & Edginton* (BRI); 93.5 km E of Muttaburra on stock route through Sumana Station, Apr 2011, *Thompson MUT487 & Edginton* (BRI). Edgbaston, SE edge of Lake Mueller, *c.* 30 km NE of Aramac, May 2015, *Thompson MUT563* (BRI).

***Distribution and habitat*:** *Atriplex alces* has been collected from two general locations about 44 km apart **(Map 1).** The new species is only known from swales associated with weathered dunes within Regional Ecosystem (RE) 10.3.29b with vegetation described as hummock grasslands dominated by *Triodia longiceps* J.M.Black in the Desert Uplands Biogeographical Region of Queensland (Queensland Herbarium 2016) **(Fig. 16).**

***Phenology*:** *Atriplex alces* is only known to flower and fruit from March to April, as all specimens have been collected during this time period.

QUEENSLAND HERBARIUM (BRI)
Brisbane Australia
AQ 862756
QUEENSLAND HERBARIUM (BRI)
Flora of Queensland Mitchell
Atriplex
Coll. E.J. Thompson MUT401 8 APR 2010
Edginton,M.;
22d 45m 56s 145d 25m 59s [WGS84] Depth m
(55,339127,7481581) (7952-391815) Alt. m
On Edgbaston Station 33km NNE of Aramac.
Hummock grassland of Triodia longiceps on weathered dunes.
Occasional ascending herb to 30cm tall.
Fruit has some similarities to Atriplex eardleyae.
Det. E.J. Thompson MAY 2010 44 Chenopodiaceae
Dup.
* May be cited as computerised collection Number AQ 862756
(Archival Paper)
Queensland Herbarium (BRI)
Atriplex sp. (Edgbaston E.J. Thompson + MUT401)
Det. E.J. Thompson Date 23/07/2011
cm
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Fig. 1. Holotype of ***Atriplex alces*** (*Thompson MUT401 & Edginton*, BRI). Photo: M.A. Edginton.

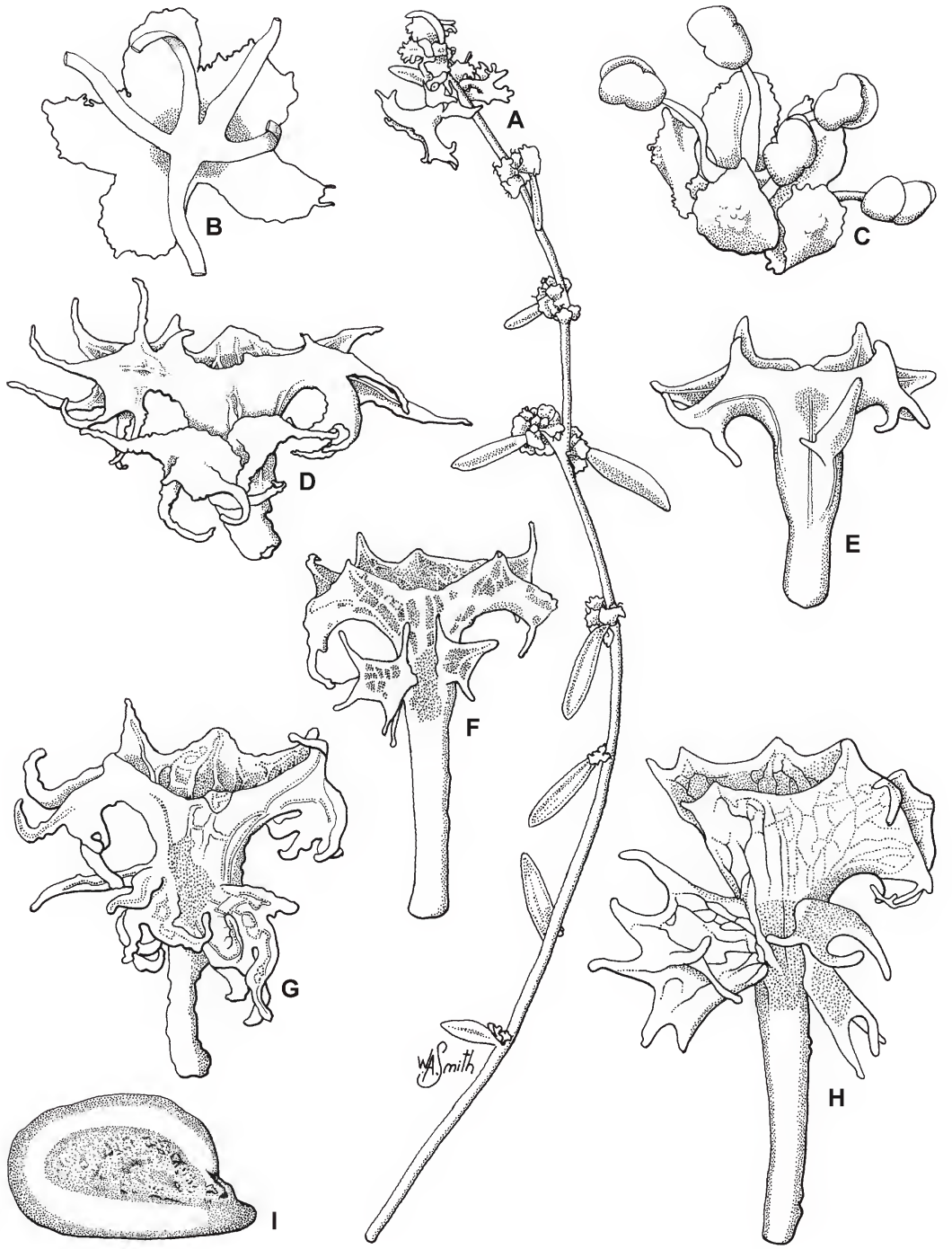

Fig. 2. ***Atriplex alces***. A. portion of branch including leaves, male inflorescences and mature and immature fruits. B. male flower opened and with anthers removed from filaments. C. male flower. D–H. fruits, showing variation in shape, not only between specimens but within a specimen. I. seed. A–C, E–F from *Thompson MUT481 & Edginton* (BRI); D, G, I from *Thompson MUT401 & Edginton* (BRI); H from *Thompson MUT483 & Edginton* (BRI). Del. W. Smith.

Fig. 3. ***Atriplex alces***. fruits with short pedicels (*Thompson MUT401 & Edginton*, BRI). Scale as indicated. Photo: E.J. Thompson.

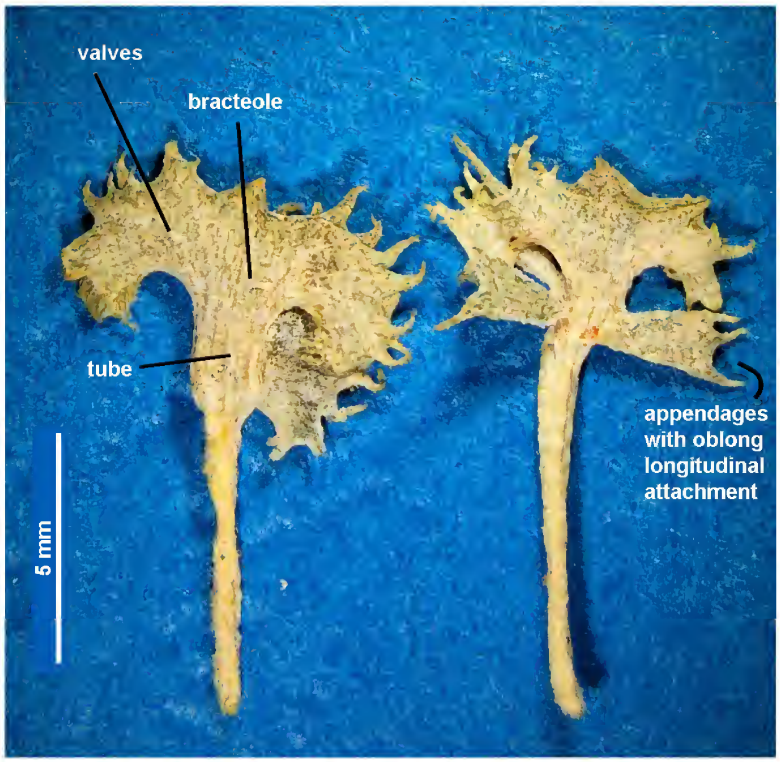

Fig. 4. ***Atriplex alces***. fruits with long pedicels (*Thompson MUT401 & Edginton*, BRI). Scale as indicated. Photo: E.J. Thompson.

Fig. 5. ***Atriplex eardleyae***. fruit (*Forster PIF35287 & Thomas*, BRI). Scale as indicated. Photo: E.J. Thompson.

Fig. 6. ***Atriplex alces***. seed (*Thompson MUT481 & Edginton*, BRI). Photo: E.J. Thompson.

Fig. 7. ***Atriplex alces***. seed (*Thompson MUT481 & Edginton*, BRI). Photo: E.J. Thompson.

***Affinities*:** The fruits of *Atriplex alces* resemble *A. eardleyae* (Section IV. Semibaccatae, Wilson 1984). Both species have unequal bracteoles *c.* half united, tube flattened and two foliaceous dorsal appendages. The two species are distinguishable by the leaves and other characters presented in **Table 1**.

Table 1. Morphological comparison of *Atriplex alces* and *A. eardleyae*

Character	*Atriplex alces*	*Atriplex eardleyae*
Valve lobe division	Moderately to highly divided, with fine subulate to very narrowly deltoid divisions at the extremities (antler-like) (**Figs. 2D–H, 3–4**)	Undivided to slightly divided, without fine subulate to very narrowly deltoid divisions at the extremities (not antler-like) (**Fig. 5**)
Bracteole dorsal appendages size (when present) and placement	Sometimes absent but usually present, small to large; often extends to distal ends of valve and often mimics in appearance the concomitant side (LHS or RHS) of valve (**Figs. 3–4**)	Absent or small; only at base of valve (**Fig. 5**)
Seed shape	± oblong-elliptic (**Figs. 2I, 6–7**)	Cordate-orbicular (**Figs. 8–9**)
Seed length	*c.* 2 mm	Usually much less than 2 mm
Leaf shape of most leaves on any one specimen	Narrowly oblanceolate to linear (**Fig. 10**)	Elliptic to sub-orbicular (**Fig. 11**)
Leaf margin	Always entire (**Fig. 10**)	Entire, coarsely dentate or lobed (**Fig. 11**)
Leaf scurf thickness	Usually multi-layered, obscuring venation (**Figs. 12&14**)	Usually one or two layers – venation clearly visible (**Figs. 13&15**)
Leaf colour	± grey (**Fig. 10**)	Greyish green (**Fig. 11**)
Leaf reticulation	Not visible under high magnification – if any exists it is obscured by scurf (**Fig. 12**)	Clearly visible through the scurf under high magnification (**Fig. 13**)

Fig. 8. ***Atriplex eardleyae***. seed (*Forster PIF35287 & Thomas*, BRI). Photo: E.J. Thompson.

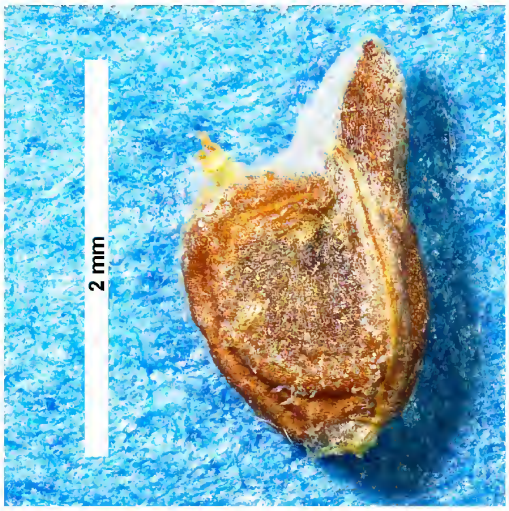

Fig. 9. ***Atriplex eardleyae***. seed (*Forster PIF35287 & Thomas*, BRI). Photo: E.J. Thompson.

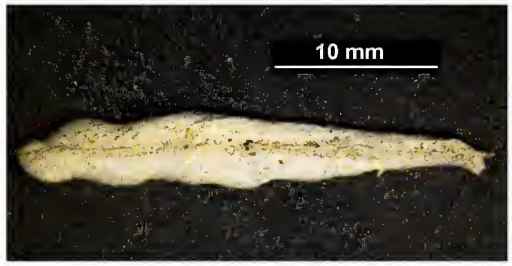

Fig. 10. ***Atriplex alces***. abaxial view of leaf (*Thompson MUT401 & Edginton*, BRI). Scale as indicated. Photo: E.J. Thompson.

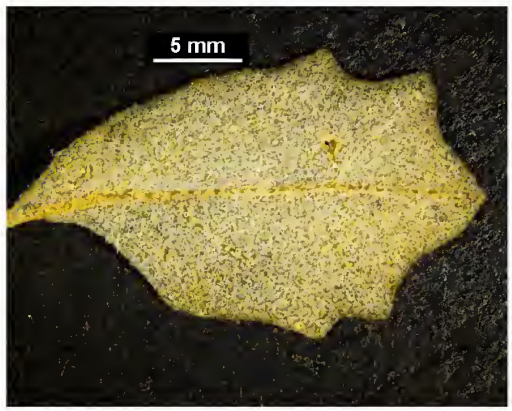

Fig. 11. ***Atriplex eardleyae***. abaxial view of leaf (*Forster PIF35287 & Thomas*, BRI). Scale as indicated. Photo: E.J. Thompson.

Fig. 12. ***Atriplex alces***. abaxial view (close-up) of leaf (*Thompson MUT401 & Edginton*, BRI). Scale as indicated. Photo: E.J. Thompson.

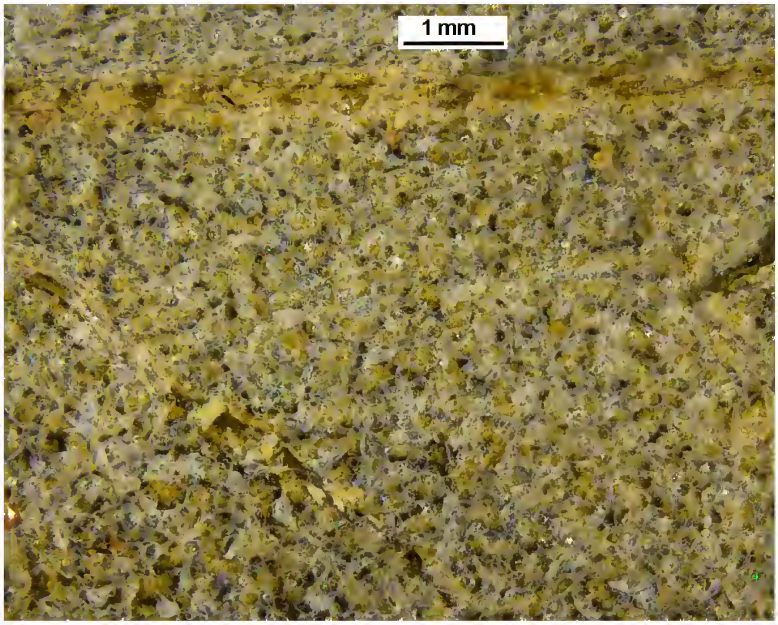

Fig. 13. ***Atriplex eardleyae***. abaxial view (close-up) of leaf (*Forster PIF35287 & Thomas*, BRI). Scale as indicated. Photo: E.J. Thompson.

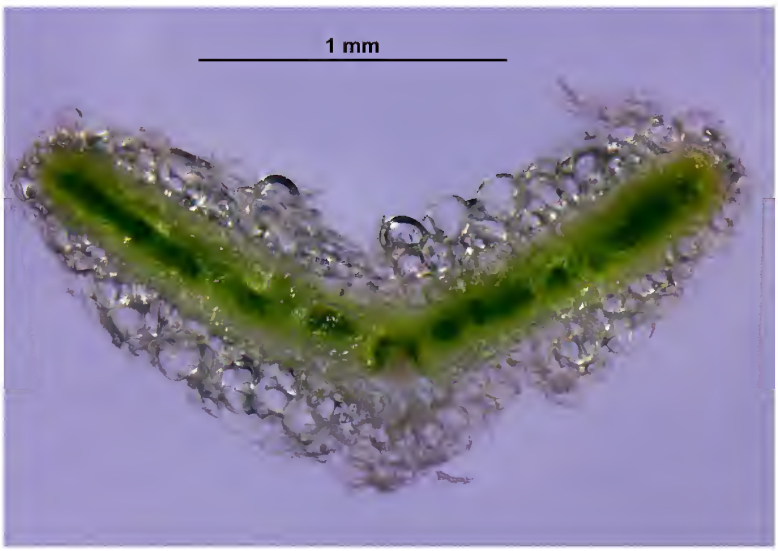

Fig. 14. ***Atriplex alces***. transverse section of leaf (*Thompson MUT563 & Edginton*, BRI). Scale as indicated. Photo: E.J. Thompson.

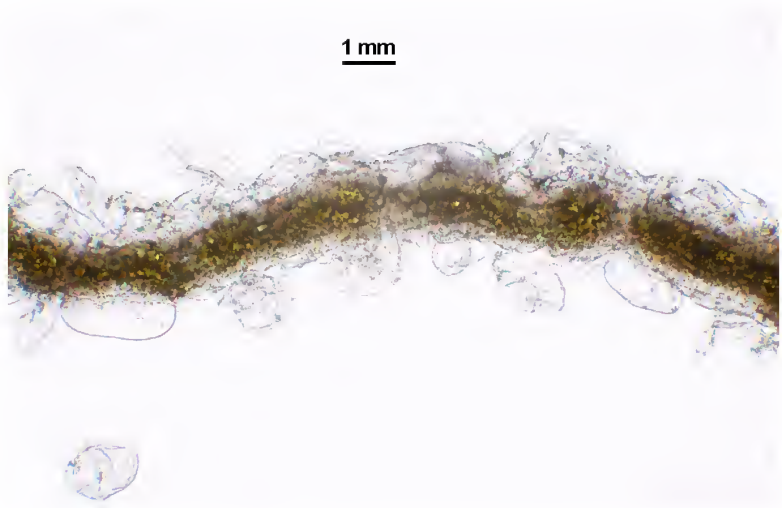

Fig. 15. ***Atriplex eardleyae***. transverse section of leaf (*Forster PIF35287 & Thomas*, BRI). Scale as indicated. Photo. E.J. Thompson.

Fig. 16. ***Atriplex alces***. habitat (locality for *Thompson MUT563 & Edginton*, BRI). Photo. E.J. Thompson.

Fig. 17. ***Atriplex alces***. habit (*Thompson MUT563 & Edginton*, BRI). Photo: E.J. Thompson.

***Conservation status*:** *Atriplex alces* is only known to occur in RE 10.3.29, which has a *Vegetation Management Act 1999* class of **Of Concern** due to its very limited area of approximately 1000 ha. 10.3.29 also has a Regional Ecosystem Description Database (REDD) Biodiversity Status of **Endangered**. The REDD Biodiversity Status Notes for 10.3.29 state "Greater than >70% severely degraded by trampling and wind erosion". *Atriplex alces* was observed in two small populations. Field inspection of the population at Edgbaston in May 2015 revealed no plants at the site of collection of the type specimen although another small population was found nearby. No disturbance was evident.

However, in terms of IUCN categories, there is insufficient data to support a classification of **Critically Endangered** or **Endangered.** The existing data does support a classification of **Vulnerable** (criterion D2) (IUCN 2001). We therefore recommend this species to be classified as **Vulnerable** under the IUCN and *Nature Conservation Act 1992*. We also recommend that this species is the subject of surveys to determine if it meets the criteria for higher categories under the IUCN and *Nature Conservation Act 1992*.

***Etymology*:** The specific epithet *alces* is Latin for "moose", and refers to the highly divided distal extremities of the valves and appendages of the fruit, which cause the fruits to resemble antlers.

Acknowledgements

Thanks to Paul Foreman for bringing our attention to this new species; Tony Bean (Queensland Herbarium) for the distribution map and Will Smith (Queensland Herbarium) for the drawings.

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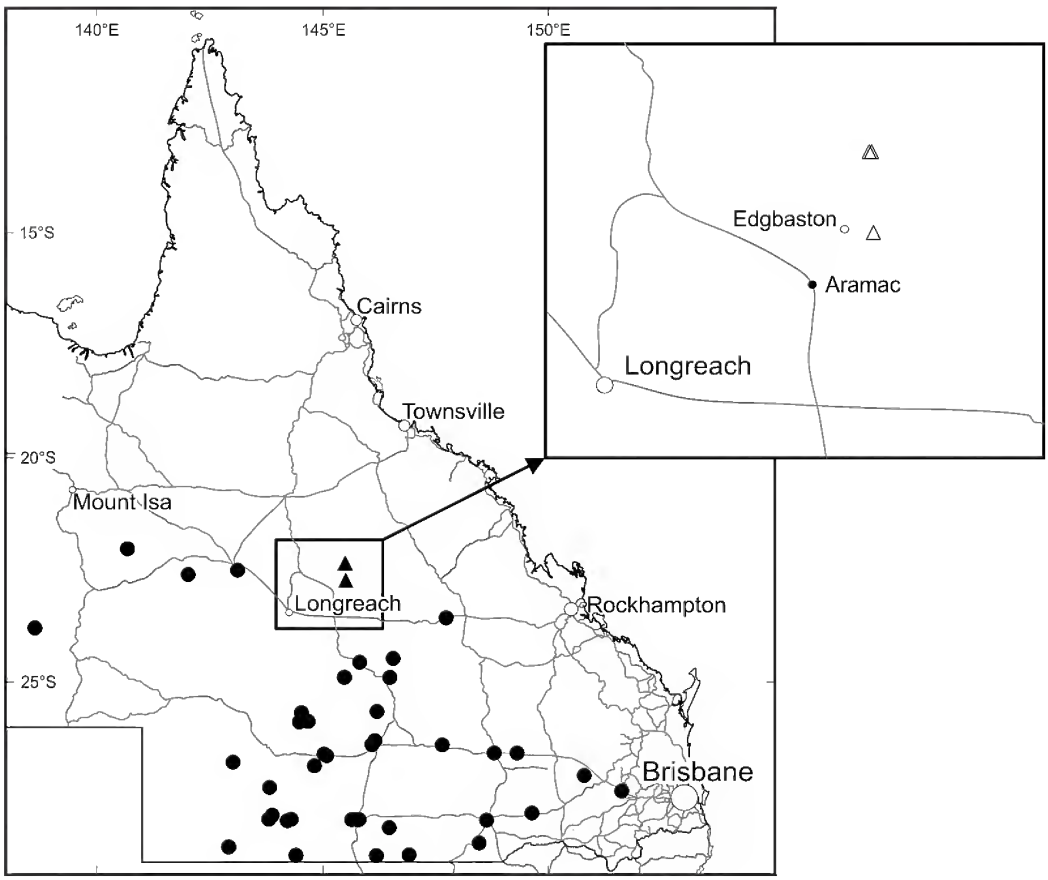

Map 1. Distribution of ***Atriplex alces*** (▲) and ***A. eardleyae*** (●). The two top markedly over-lapping triangles in the inset actually indicate three proximal records that cannot be effectively spatially separated at this scale. Del: W. Smith & A. R. Bean.

Labichea mulliganensis A.R.Bean (Leguminosae: Caesalpiniodeae), a new species from Queensland

A.R. Bean

Summary

Bean, A.R. (2017). *Labichea mulliganensis* A.R.Bean (Leguminosae: Caesalpiniodeae), a new species from Queensland. ***Austrobaileya* 10(1): 196–199.** *Labichea mulliganensis* A.R.Bean, confined to Mount Mulligan in northern Queensland, is described as new. Illustrations are provided, as are notes on its affinities and conservation status. A key to the identification of all Queensland species of *Labichea* is included.

Key Words: Caesalpiniaceae, *Labichea*, *Labichea mulliganensis*, Australia flora, Queensland flora, taxonomy, new species, identification key

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Introduction

The genus *Labichea* Gaudich. ex DC. is endemic to Australia and Ross (1998) reported 14 species. Another species, *L. rossii* N.Gibson, has recently been named from Western Australia (Gibson 2011). All species are sclerophyllous shrubs, and almost all have pungent pointed leaflets. While there are some significant floral characteristics used to distinguish between species, notably the anther dimorphism and the number of sepals, the species are largely distinguished on vegetative features.

Mount Mulligan in north Queensland is a well-known botanical hot-spot, being home to several endemic or highly restricted plant species. A species of *Labichea*, endemic to this mountain, is here described. The new species is clearly related to *L. brassii* C.T.White & Francis, but can be immediately distinguished from it by leaflet shape alone. A key to the identification of the six Queensland species of *Labichea* is provided.

Materials and methods

This study is based on the morphological examination of specimens held at BRI. Measurements are taken from dried material except for floral parts, which were measured from material preserved in spirit, or reconstituted boiling in water.

Accepted for publication 29 September 2017

Taxonomy

Labichea mulliganensis A.R.Bean **sp. nov.** with affinity to *L. brassii*, but differing by the terminal leaflet 3.5–4.6 times longer than broad, the dense hairs on the lower side of the leaflet, the leaflet margins without glands, and the longer of the two anthers 6.5–7.8 mm long. **Typus:** Queensland. Cook District: Mount Mulligan, *c.* 0.5 km S of the mine site along the pipeline leading to the falls on Richards Creek, 11 April 1984, *J.R. Clarkson 5255* (holo: BRI!; iso: CANB, CNS, DNA, K, L, MEL, MO, PERTH, *all n.v.*).

Shrub to 3 m high. Branchlets densely pubescent with erect eglandular hairs, mostly 0.1–0.5 mm long, occasionally longer. Stipules deltate, brown, 3–4 mm long, deciduous. Leaves pinnate, petioles 0–2 mm long, rachis 4–30 mm long; leaflets 5, 7 or 9, narrowly elliptic, shortly petiolulate, with a sharp terminal mucro 2–4 mm long; terminal leaflet 1.5–2.6 times longer than adjacent leaflets, leaflets becoming progressively smaller towards base of rachis. Terminal leaflet 21–50 mm long (excluding mucro), 6–12 mm wide, 3.5–4.6 times longer than broad; leaflets of the uppermost pair 14–24 mm long (excluding mucro), 5–8 mm wide.

Upper side green, with numerous short uncinate hairs, glabrescent; lower side with moderately dense to dense white straight eglandular hairs, mostly 0.5–0.8 mm long, and up to 1 mm long, often obscuring surface, ± appressed; leaflet margins strongly recurved, lacking glands, not undulate. Inflorescences racemose, 6–10-flowered, pedicels 5–8 mm long at anthesis, pedicels and rachis covered with dense spreading eglandular hairs. Sepals 5, the outer 2 cymbiform, deltate, thick, 7–10 × 2.6–3.9 mm, inner surface glabrous, outer surface densely covered in spreading white hairs to 3 mm long; the inner 3 flat, narrowly-deltate, thin, 5–8.1 × 1.2–2.5 mm, glabrous on both sides. Petals 4, all about the same size and shape, broadly-ovate to orbicular, 11–12 × 8.5–10 mm, glabrous, predominantly yellow but one petal with red colouration near the base. Stamens 2, filaments very short and thick, 0.5–0.8 mm long, anthers greatly unequal in size, longer anther 7–7.8 mm long, usually curved, shorter anther 3.2–3.8 mm long, straight. Ovary + style *c.* 6.5 mm long, ovary densely villous, 2-ovulate, style glabrous. Pod flattened, obliquely elliptical, 2.3–2.6 cm long, outer surface with many short erect uncinate hairs and long appressed straight hairs. Seeds ellipsoidal, brown, 4.9–5.9 mm long excluding aril. **Fig. 1.**

***Additional specimens examined*: Queensland.** Cook District: Base of Ngarrabullgan, Apr 1994, *Cassidy 2* (BRI); Mt Mulligan, on the southern plateau of the mountain, Apr 1984, *Clarkson 5302* (BRI, CANB, CNS, MEL); Mt Mulligan, *c.* 40 km NW of Dimbulah, Apr 1985, *Clarkson 5830B* (BRI, CNS); Mt Mulligan, *c.* 30 km NW of Dimbulah, Jun 1995, *Clarkson 10540* (BRI); Mt Mulligan, *c.* 30 km NW of Dimbulah, Jun 1995, *Clarkson 10544* (BRI); Mt Mulligan, Feb 1934, *Flecker s.n.* (BRI [AQ234593]; CNS [QRS31340]); SE base of Mt Mulligan, Feb 1990, *Forster PIF6291* (BRI, CNS); Mt Mulligan, southern end, Branch Creek catchment, Jul 1995, *Forster PIF17179 & Figg* (BRI, CNS); Mt Mulligan, 40 km NW of Dimbulah, Apr 1989, *Neldner 2757* (BRI, CNS); Slopes of Mt Mulligan Range, Sep 1977, *Powell 790 & Armstrong* (BRI, NSW); Base of Mt Mulligan, Mar 1986, *Walker s.n.* (BRI [AQ399830]).

***Distribution and habitat*:** *Labichea mulliganensis* is confined to Mount Mulligan, about 35 km north-west of Dimbulah, and about 100 km west of Cairns in northern Queensland. It grows in eucalypt woodland on quartzose sandstone ridges and slopes, or on ephemeral watercourses. Soils are shallow and sandy.

***Phenology*:** Flowers have been collected from February to July, and fruits have been collected in February, April and June.

***Affinities*:** *Labichea mulliganensis* differs from *L. brassii* by the narrower leaflets (terminal leaflet 3.5–4.6 times longer than broad, versus. 1.9–2.4 times for *L. brassii*); the leaflet margins lacking glands and not undulate (margins of many leaflets with 3–5 pairs of yellowish flat glands, and leaflets undulate for *L. brassii*); the underside of the leaflets moderately densely to densely hairy, with the hairs often obscuring the surface (sparsely hairy, surface readily visible for *L. brassii*); the longer anther 6.5–7.8 mm long (longer anther 5.5–6.4 mm long for *L. brassii*). *L. mulliganensis* differs from *L. buettneriana* F.Muell. by the much narrower leaflets, with the terminal leaflet much longer than the lateral ones (broad leaflets, all about the same size for *L. buettneriana*), the leaflet apices pungent (leaflet apices usually innocuous for *L. buettneriana*), and the 5–9 leaflets per leaf (7–13 for *L. buettneriana*).

***Notes*:** Ross (1985, 1988) included this species in his concept of *Labichea brassii*, although he noted a number of differences between the Mt Mulligan material and the typical form of that species.

***Conservation status*:** *Labichea mulliganensis* has an approximate extent of occurrence of 90 km^2, and is known from 7 subpopulations with an estimated Area of occupancy of 20 km^2. As there are no known threats to the species, a conservation status of **Least Concern** is recommended (IUCN 2012).

***Etymology*:** The specific epithet refers to the type locality, Mount Mulligan.

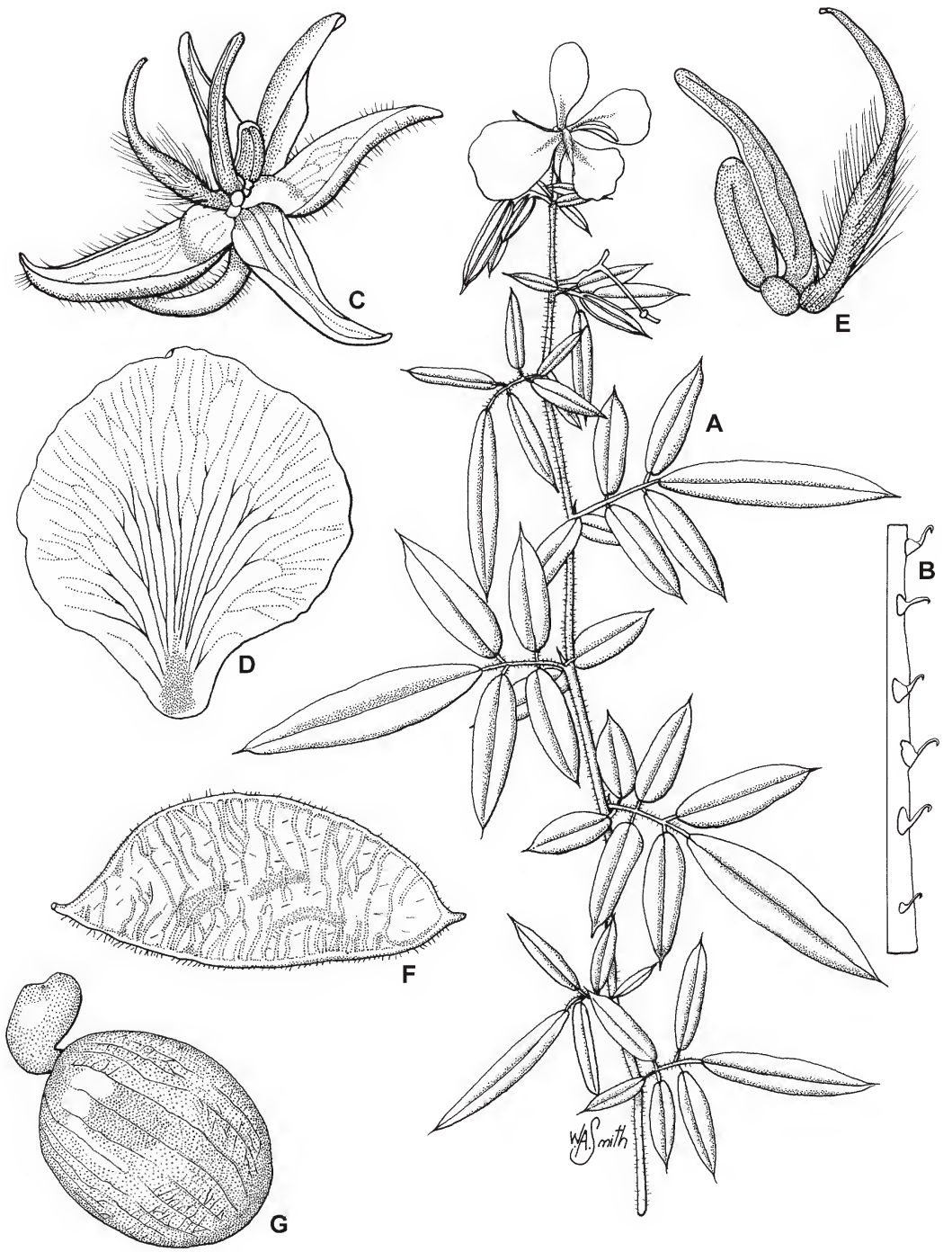

Fig. 1. ***Labichea mulliganensis***. A. flowering branchlet ×1. B. uncinate hairs on upper leaf surface ×40. C. flower (petals removed) ×4. D. petal ×4. E. stamens and style ×6. F. pod ×2. G. seed ×6. A–B, F–G from *Clarkson 10540* (BRI); C–E from *Clarkson 5302* (BRI).

Key to the Queensland species of *Labichea*

1 Leaves pinnate **2**
1. Leaves palmate **4**

2 Leaf rachis 30–150 mm long, leaflets all about same size; pods lacking uncinate hairs . . . . . **L. buettneriana**
2. Leaf rachis 2–30 mm long, terminal leaflet longer than lateral leaflets; pods with many uncinate hairs **3**

3 Terminal leaflet 3.5–4.6 times longer than broad; leaflets recurved but not undulate, marginal glands absent; the longer anther 6.5–7.8 mm long . . . . . **L. mulliganensis**
3. Terminal leaflet 1.9–2.4 times longer than broad; leaflets undulate with 3–5 pairs of flat glands along the margin; the longer anther 5.5–6.4 mm long . . . . . **L. brassii**

4 Terminal leaflet 2–5 times longer than the next longest leaflet; leaves often with 3 leaflets, otherwise 5; leaflet undersides with persistent sparse hairs along the midrib and on lamina surface . . . . . **L. rupestris**
4. Terminal leaflet 1–2 times longer than the next longest leaflet; leaflets 5 or 7, never 3; leaflet undersides glabrous or with scattered hairs along the midrib only **5**

5 Leaflets oblanceolate to narrowly obovate, 5–15 mm wide; terminal leaflet 1.3–2 times longer than next longest leaflets; anthers dimorphic (i.e. one nearly twice as long as the other) . . . . . **L. nitida**
5. Leaflets linear or very narrowly elliptic, 1.5–3 mm wide; all leaflets about the same length; anthers very similar in size . . . . . **L. digitata**

Acknowledgements

I am grateful to Will Smith (BRI) for the excellent illustrations, and to Frank Zich (CNS) for commenting on the manuscript.

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Didymoplexis micradenia (Rchb.f.) Hemsl. (Orchidaceae): A new record for the Australian flora

B. Gray

Summary

Gray, B. (2017). *Didymoplexis micradenia* (Rchb.f.) Hemsl. (Orchidaceae): A new record for the Australian flora. ***Austrobaileya* 10(1): 200–204.** *Didymoplexis micradenia* previously recorded from many western Pacific islands, Java and Vietnam, was recently discovered in north Queensland and is a new species record for Australia. Morphologically this species is similar to *D. pallens* Griff., which was, until now, the only known representative of the genus in Australia. *Didymoplexis micradenia* has a much smaller, pinkish-white flower, a shorter column foot and toothed apical margin of the lip. A description based on Australian material, concurring with the protologue, photographs and a key to *Didymoplexis* in Australia are provided here.

Key Words: Orchidaceae, *Didymoplexis, Didymoplexis micradenia*, Australia flora, Queensland flora, new species record, taxonomy, identification key

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Introduction

Didymoplexis Griff. is a small genus of about 20 species of leafless, achlorophyllous terrestrial orchids distributed from Africa, through to Madagascar, India, Ryukyu Islands, Taiwan, Southeast Asia, northern Australia and the Pacific Islands (Pridgeon *et al.* 2005). In Australia, *D. pallens* Griff., the type species of the genus, has been the only member of the genus recorded occurring in northern Australia from the Kimberley region of Western Australia to northern Queensland (Dockrill 1992; Jones *et al.* 2010).

A recent collection from the Daintree National Park in north Queensland's Wet Tropics, reveals a previously unrecorded *Didymoplexis* taxon, *D. micradenia* (Rchb.f). Hemsl., a species previously recorded from Vietnam, West Java, Taiwan, Palau, Samoa, Vanuatu, Tonga, Niue and New Caledonia (Smith 1905, 1908; Lewis & Cribb 1989, 1991; Comber 1990; Cribb & Whistler 1996; Hsu & Chung 2007). *Didymoplexis micradenia* is closely related to *D. pallens* but differs in having smaller flowers, and a suite of different floral morphological characteristics.

Materials and methods

This study is based on examination of living plants in the field and preserved spirit collections deposited in the Australian Tropical Herbarium (CNS) (herbarium acronym follow Thiers (continuously updated)). Measurements were made using live specimens in the field and also from spirit materials, namely *Gray BG9752, de Groot & Hawkes* (CNS) and *Gray BG9753, de Groot & Hawkes* (CNS). The isotype specimen at K was viewed online.

Key to the Australian species of *Didymoplexis*

1 Flowers crystalline white; column foot *c.* 2 mm long; lip 5–7 mm long, 6–9 mm wide, side lobes exceeding the apex. . . . . **D. pallens**

1. Flowers pinkish-white; column foot less than 1 mm long; lip obovate, 4–6 mm long, 4–5 mm wide, margin of apex rounded and toothed. . . . . **D. micradenia**

Accepted for publication 21 July 2017

Taxonomy

Didymoplexis micradenia (Rchb.f.) Hemsl., *J. Linn. Soc., Bot.* 20: 311 (1883); *Epiphanes micradenia* Rchb.f., *Fl. Vit. [Seemann]* 295 (1868). **Type:** Fiji. Ovalau, in 1860, *B.C. Seemann 610* (holo: W *n.v.*; iso: K 000942690).

Leafless and achlorophyllous terrestrial herb 6–18 cm high with a subterranean, pale yellowish brown, fleshy, rhizome, 2–5 cm long. Inflorescence upright, glabrous, pale brown, a raceme bearing 3–8 pinkish white flowers that open one at a time. Flowers pinkish white, not opening widely, sepals and petals connate at the base, forming a tube. Pedicel and ovary, 6–8 mm long, glabrous; Sepals and petals connate for *c.* 2/3 of their length, hooded over the column and forming a tube; dorsal sepal 8–10 mm long, petals shorter; lateral sepals 6.5–7 mm long connate for *c.* 3/4 of their length, united with the petals near the base, the structure broadly bilobed and strongly deflexed in the upper 1/3. Labellum white, obovate, erect on both sides, 6–7.5 mm long, 5–6 mm wide when flattened, apex obtuse, with small irregular teeth, disc with a longitudinal raised, pinkish, warty keel. Column white, clavate, 6–7 mm long, apex furnished with 2 rhombic wings, column foot inconspicuous, < 1 mm long; pollinia 4 in 2 pairs. Capsule 2–2.3 cm long, triangular in cross section; pedicel elongates 12–20 cm long after fertilisation. **Figs. 1–4.**

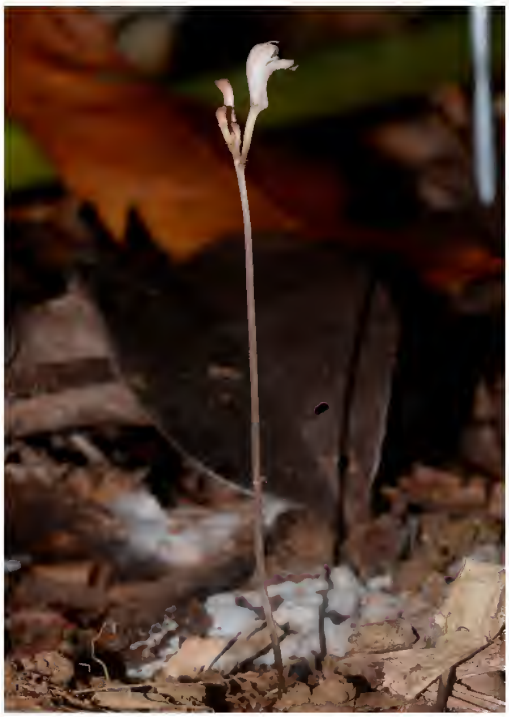

Fig. 1. ***Didymoplexis micradenia***. growth habit of a mature flowering plant. (*Gray BG9752*, CNS). Photo: T. de Groot.

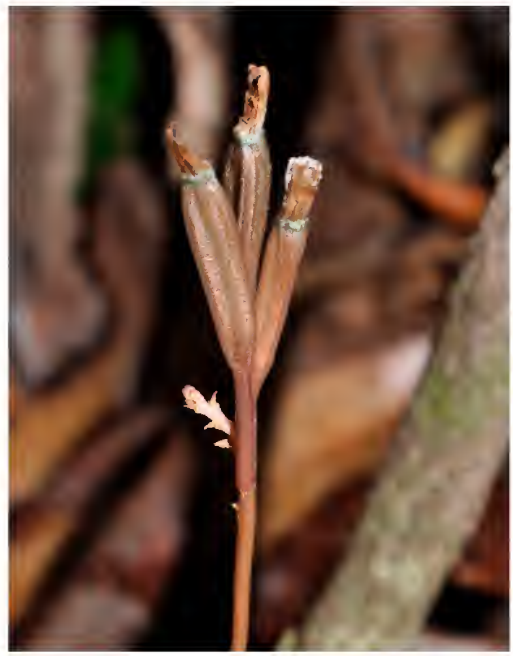

Fig. 2. ***Didymoplexis micradenia***. close-up of immature fruits (*Gray BG9753*, CNS). Photo: T. Hawkes.

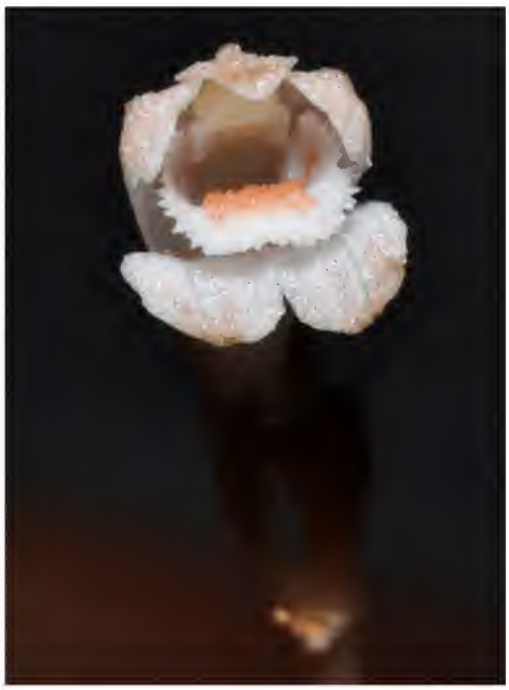

Fig. 3. ***Didymoplexis micradenia***. face view of an open flower (*Gray BG9752*, CNS). Photo: T. de Groot.

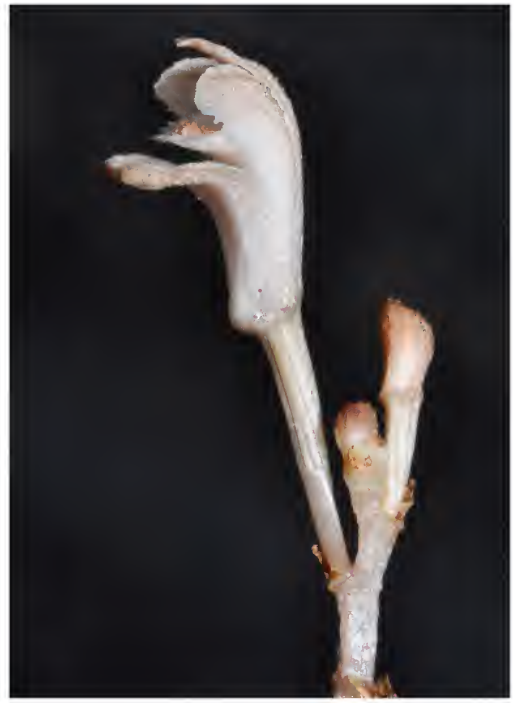

Fig. 4. ***Didymoplexis micradenia***. lateral view of an open flower (*Gray BG9752*, CNS). Photo: T. Hawkes.

***Additional specimens examined*: Queensland**. Cook District: Whyanbeel, Daintree National Park, High Falls Creek, Oct 2016, *Gray BG 9752, de Groot & Hawkes* (CNS); *ibid*., Oct 2016, *Gray BG9753, de Groot & Hawkes* (CNS).

***Distribution and habitat*:** The population of *Didymoplexis micradenia* in the Whyanbeel Valley of the Daintree National Park occurs under dense tree cover in rainforest over granite substrate. As these plants are very difficult to spot amongst dry leaves on the forest floor, it is likely that *D. micradenia* may be more common and widespread than recorded in this study. Currently, only 13 individuals have been located, despite extensive searching and all are within an area of approximately 200 × 20 m. Most plants observed were fruiting, with only five flowering individuals observed during the study.

***Notes*:** The first plant of this species was discovered by Tony de Groot, who spent many days in the field to locate more plants and extend the population. During observations carried out together with Tony de Groot and Tim Hawkes, it was observed that flowers begin to open at about 10 am and by 1–1.30 pm are closing. In the field, we failed to observe any potential pollinators. However, we did notice that small diptera often visited the flowers without entering. No perfume was detected from the flowers.

The other species of *Didymoplexis* that can be found in Australia, *D. pallens,* usually occurs in open forest situations, flowering soon after the beginning of the wet season. In contrast, based on our limited field observations made during the study timeframe, we conclude that *D. micradenia* is restricted to the rainforest, under dense tree cover, flowering possibly after any heavy summer rain events. In addition, flowers of *D. pallens* are crystalline white and larger in size (5–9 mm) (**Figs. 5–7**) compared with the pinkish-white flowers of *D. micradenia* that are smaller, flowers (4–5 mm).

Fig. 5. ***Didymoplexis pallens***. growth habit of mature flowering plants amongst grass and sedges in open forest (*Gray BG4966*, CNS). Photo: B. Gray.

Acknowledgements

I would like record my sincere thanks to Tony de Groot, Tim Hawkes and David Baume who have spent countless hours observing these plants for good flowering material for close inspection, as well as the images used here in this paper. Professor Darren Crayn kindly provided me with access to the Australian Tropical Herbarium (CNS). I am grateful to Frank Zich (CNS) and Yee Wen Low (Singapore Botanic Garden) for locating all the literature pertinent to this research and their constructive criticisms in improving the manuscript.

Fig. 6. ***Didymoplexis pallens***. lateral view of an open flower (*Gray BG4966*, CNS). Photo: B. Gray.

Fig. 7. ***Didymoplexis pallens***. face view of an open flower (*Gray BG4966*, CNS). Photo: B. Gray.

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SHORT COMMUNICATION

Pittosporum tinifolium A.Cunn.: a corrected name and reinstatement at species level for the Queensland species currently known as the rusty-leaved pittosporum, *Pittosporum ferrugineum* subspecies *linifolium* (A.Cunn.) L.Cayzer *et al.* (Pittosporaceae)

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Pittosporaceae is a mostly Australian flowering plant family characterised by narrow endemism and very few wide ranging species (Cayzer *et al.* 2000). The poorly known, 'rusty-leaved Pittosporum', *Pittosporum ferrugineum* W.T.Ait., is one of the few species in Australia believed to have a range to at least Australia's northern neighbours in Malesia, if not further into Asia. The uncertainty surrounding this taxon is in part due to the brief and ambiguous protologue by Aiton, and the subsequent difficulty in establishing which taxon of many is the original source of the unremarkable, almost sterile type specimen of Aiton's *Pittosporum ferrugineum s.str.*, taken in 1795 from 'shrubs' (Bentham 1863) cultivated at Kew.

Previous reviewers of *Pittosporum*, including Bentham (1863), Ridley (1922) and Cooper (1956) had already highlighted different 'forms' across the range, but had insufficient information or specimens available to make formal separations. As part of a revision of the family within Australia, originally intended for the *Flora of Australia* series, Cayzer *et al.* (2000: 890, fig. 18) also recognised that at least two 'forms' of this taxon occurred in disjunct distributions in north-east Queensland. Until this taxon could be fully investigated across its purported range, Cayzer *et al.* (2000) suggested several subspecies including:

- *P. ferrugineum* subsp. *ferrugineum*, reportedly the taxon in Australia at its northern extremities in Queensland (north of Cooktown) and Northern Territory; and
- *P. ferrugineum* subsp. *linifolium* (A.Cunn.) L.Cayzer *et al.* based on *P. linifolium* A.Cunn., the earliest of several synonyms at species level for this fairly common taxon in coastal areas of Queensland (south of Cooktown).

The rusty-leaved pittosporum complex has recently been comprehensively investigated across its range (Cayzer & Chandler in prep.), and several changes are needed in these taxa.

First, the epithet *linifolium* needs correction. Bentham (1863: 112) states quite emphatically in his *Flora Australiensis* that the species name 'linifolium' was a printing error: *'P. tinifolium* (*linifolium* by an error of the press) A.Cunn. …'. There is also no suggestion here by Bentham, nor in the (apparently error prone) protologue publication that the manuscript name should be attributed to Richard Cunningham, as cited by Chapman (1991), in the *Australian Plant Name Index*. Accordingly, this species should be cited as *Pittosporum tinifolium* A.Cunn.

Second, the revision by Cayzer and Chandler (in prep.) shows that Cunningham's Queensland taxon should be reinstated at

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species level. *Pittosporum ferrugineum s.str. sensu* W.T.Aiton occurs in northern Australia north of Cooktown in Queensland and in the Northern Territory. *P. ferrugineum* is now known to be uniquely ± monoecious with few flowered inflorescences held barely past the surrounding foliage. Cunningham's *Pittosporum tinifolium* is functionally dioecious, with inflorescences of aggregated umbels of male or female flowers held prominently above the surrounding vegetation on slender, nodding stalks. A key to the two 'rusty-leaved' *Pittosporum* species in Northern Queensland follows:

1 Leaves elliptic to almost orbicular, thick-coriaceous, upturned, apices rounded or acute; inflorescences multi-flowered stalked umbels exserted well past surrounding foliage. Common and endemic to coastal areas south of Cooktown, in Cook, North Kennedy and Port Curtis districts, Queensland . . . . . **Pittosporum tinifolium**

1. Leaves narrow elliptic to elliptic, thin-coriaceous, downturned, apices tapering, terminating in an acuminate drip tip; inflorescences from single flowers to fewer flowered umbels barely past the surrounding foliage. In Australia, sporadic in coastal areas north of Cooktown in Queensland (including islands in the Torres Strait) and Kakadu, Northern Territory . . . . . **Pittosporum ferrugineum**

Acknowledgements

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